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Standard Data Sheets for Machine Tool Builders and Users

By A. L. Evans*

One form for all kinds of machine tools—Use of the sheets eliminates waste in engineering, production and maintenance work — Wide adoption desirable and probable

IN ORDER to simplify my work of planning, routing, designing, equipping tools, making time studies, changing factory layout and similar tasks, I have devised a series of standard data sheets of which several examples are shown on succeeding pages. The standard data sheets cover many types and sizes of machine tools, giving in a uniform, practical and comprehensive manner all of the information required in performing the duties just outlined. The data are definitely tied up to the builders' serial numbers and the sheets are arranged to be filed in a loose leaf binder of standard size.

The development of the data sheets has been a process of evolution. The scarcity of information in usable form had been brought to my attention continually during my eighteen years' practical experience with several large manufacturing plants. Much of the information needed in the kinds of work in which I engaged is available in makers' catalogs, circulars, blueprints and in other forms. The great variety of sizes and the many ways of presenting the information made binding and filing the sources impossible.

The plan that I devised to make my own work easier has been used constantly in practice for several years and has served its purpose perfectly. It has been the means of stopping many leaks and saving many hours which formerly had been utterly wasted. The possibilities of the data sheets as an economy are legion because the amount of time spent in the entire industry in searching for information either in catalogs or in the shop is enormous.

Examples of the data sheets in reduced size are shown on the pages following. The full size is 11x7 in., a size chosen because it is convenient to handle and because it gives room on which to compile the required information without crowding. The sheets can be filed flat in a standard loose leaf binder or can be folded into letter size.

One Form for All Kinds of Machines

The standard form used for all kinds of machine tools is made with ¼-in. margin outside the border except on the left end where 1-in. margin is left for binding. At the top of the sheet, in a ruled section, are given the title of the sheet, builder's name and location, builder's serial number, trade name and description of machine tool, and user's machine number. At the bottom of the sheet are given the drawing number, date and other details.

Arrangement of Data

The data are arranged in a manner uniform for all types of machine tools. A complete record of the installation is given in the top left corner. Front and end views of the machine are shown in the center of the sheet, these views giving the dimensions of the general

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MACHINE TOOL STANDARD DATA SHEET

BUILDER'S NAME
THE BULLARD MACHINE TOOL CO.
BRIDGEPORT, CONN, U.S.A.

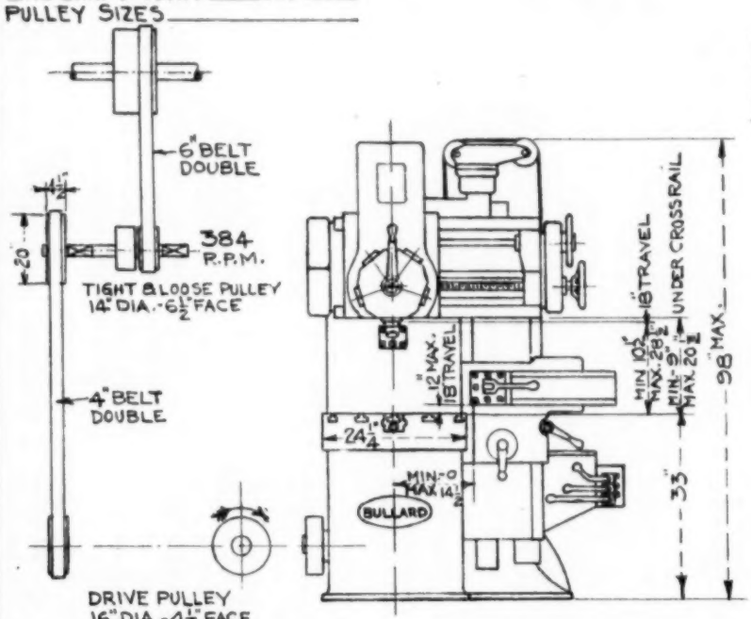
BUILDER'S SERIAL NUMBER

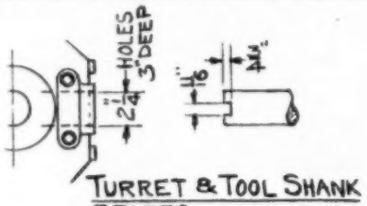
MACHINE DESCRIPTION
BULLARD 24 INCH VERTICAL TURRET LATHE

USER'S MACHINE NUMBER

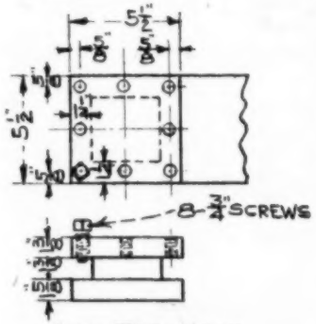
INSTALLATION

LINE SHAFT - R.P.M. ____ DIA. ____
PULLEY SIZES ____





TURRET & TOOL SHANK
5 FACES



SIDE TOOL HEAD
1" X 1¼" TOOLS

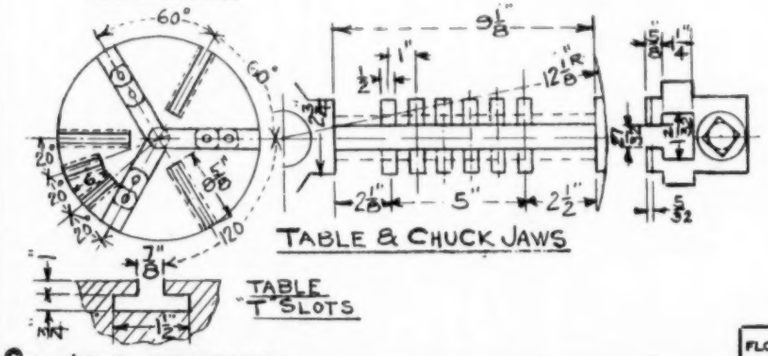
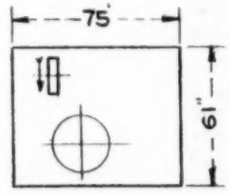


TABLE & CHUCK JAWS

TABLE T SLOTS



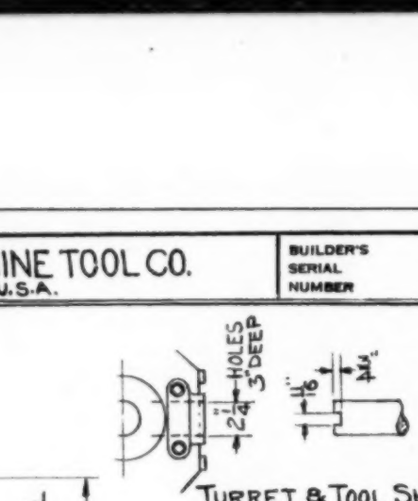
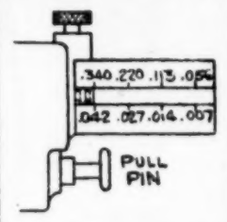


TABLE SPEEDS PULLEY 480 R.P.M.

COMB'N	R.P.M.	POSITION OF LEVERS	
		LOWER	UPPER
1A	7.0	1	A
2A	11.0	2	
3A	16.0	3	
4A	22.0	4	
1B	40.0	1	B
2B	60.0	2	
3B	86.0	3	
4B	120	4	

FEEDS PER REVOLUTION OF TABLE FOR VERTICAL & SIDE HEAD

SYM.	AMOUNT	PULL PIN
a	.007	OUT
b	.014	
c	.027	
d	.042	
e	.056	IN
f	.113	
g	.220	
h	.340	



CAPACITY -
26 INCHES IN DIAMETER
20 INCHES IN HEIGHT UNDER CROSS RAIL
28½ INCHES UNDER TURRET FACE

FACTORY LAYOUT

FLOOR PLAN ¼ IN. - 1FT.	HP. 7½	WT. 9000	DR. BY A.L. EVANS	DATE 5-11-22	DWG. NO.

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range of the machine. Details of the spindle and spindle nose, of the turret and of other parts where necessary are shown above the views of the machine proper. Details of tables, bases, cross-slides, tee slots, etc., are shown below.

A floor plan is given at the bottom of the sheet drawn on a scale of ¼ in. to the foot. In this plan the location of the drive pulley is indicated. The horsepower required and the weight of the machine are stated.

Under the heading "Machine Description" there is given a table of available spindle speeds in revolutions per minute and feeds per revolution of spindle. The positions of levers and belts are shown, or a table is given showing the change gears necessary to obtain feeds or speeds.

Space is provided under the heading "User's Machine Number" in which may be recorded the numbers of all machines in the plant of the make and size for which the sheet is made. One sheet can be used for each machine where preferred.

With the data uniformly arranged the user will know just where to locate certain information on any sheet.

The data sheets can be used to advantage by the following departments:

Installation (millwright)
Factory Layout
Estimating
Planning, Routing and Machine Capacity
Tool Designing
Time Study and Instruction
Miscellaneous

Advantages in the Use of the Data Sheets

I have analyzed the work of the departments mentioned and it appears that the advantages in using the data sheets are most clearly brought out by the subdivisions following, arranged under the several department headings:

Installation (millwright)

(a) A complete record of installation, showing, for belt-driven machines, the speeds and diameters of line and countershafts, the sizes of pulleys and belts; and for the motor-driven machine, a record of the motor, sprockets, chains, gears and other details. Space is provided on each sheet for recording this information.

The possession of the information as outlined, arranged in standard form, has these advantages:

(b) Eliminates considerable loss of time that would be used in checking pulleys, belts and other details when machinery is moved.

(c) Creates definite standards in regard to pulleys and belts and tends to standardize machine tool conditions in regard to power and speed and in other ways. Standardization in these particulars is very important. For example, when two or more operators are working on the same operation, performed on the same type and size of machine at the same piece price, conditions must be equal.

(d) Makes it possible for the department to be operated with a minimum of supplies.

Factory Layout

The floor plan for each machine is drawn to a scale of ¼ in. to the foot, the size most commonly used for factory layout purposes and the drive pulley is shown in its correct position. This information

(a) Saves considerable time when making manikins and placing machine tools in their proper driving positions on the floor.

The horsepower and weight of each machine are given, making it possible to

(b) Estimate quickly and accurately the loads on the various units of line shafting and the floors.

Estimating

By using the data pertaining to speeds and feeds, and the information concerning tools which can be used on the machine, the estimating department

(a) Can figure very closely the production time on any job.

Planning, Routing and Machine Capacity

When planning and routing the various machining operations through the factory, the work is much simplified because

(a) Guessing, as to what size of machine shall be assigned this or that operation, is eliminated. The sheets contain all necessary data of sizes, and comparison of the sheets of machines of different sizes will indicate at once which is the logical choice for the job.

This ability to compare readily the capacities of machines results in

(b) Assigning the proper machine to a given operation.

(c) Maintaining a balanced condition with large work on large machines, where great power is likely to be necessary, and with small work on small machines, where speed will probably be the general requirement.

(d) Shifting jobs from one machine to another without having to investigate sizes in the factory.

Tool Designing

All dimensions necessarry to enable the tool designing department to design special tools, jigs and fixtures, without going into the factory each time for the information, are given. They

(a) Eliminate errors in measurement, which often prove costly.

(b) Save many hours of machine production time, that are wasted by interfering with the operator while measurements are being taken.

(c) Prevent costly mistakes that would be made by working from out-of-date catalogs and specifications. (All data on these sheets are tied up to the bulider's serial number.)

(d) Keep the tool designers at the board producing instead of obliging them to spend time in the shop taking measurements.

Time Study and Instruction

(a) For time study work the data sheets may be used in book form as shown in the halftone illustration, or the speed and feed table may be cut off along the line provided for that purpose to form a table of convenient size which can be attached to the machine to replace the speed and feed tables furnished by the builder. Often it is necessary to replace the builder's table because the drive pulley or countershaft speed recommended by the builder was changed to make possible a range of speeds to give certain cutting speeds for work routed to the machine. In changing the drive pulley or countershaft speeds, the plate furnished by the builder becomes void and a new plate would entail some expense and a great deal of inconvenience. The standard data sheets are flexible in this respect, inasmuch as the change can be made in a few minutes by the aid of a slide rule or logarithmic scale.

(b) It has been proved that a time study man can accomplish twice the work if he knows without doubt the available speeds and feeds of each machine. For instance, the time study man, knowing in advance the diameter of work and cutting speeds (in feet per minute) can determine the revolutions per minute. Then finding the corresponding r.p.m. in the speed and feed table, he can direct the operator to just what position the levers or belts must be set to give the required cutting speed. It is unnecessary to count the revolutions or measure the feed. Thus because the proper combination of speed and feed are obtained on the first

Form No. 100

MACHINE TOOL STANDARD DATA SHEET

BUILDER'S NAME

CONSOLIDATED MACH. TOOL CORP'N OF AMERICA

NEW YORK, N.Y. U.S.A.

COLBURN MACH. TOOL PLANT, CLEVELAND, OHIO

BUILDER'S SERIAL NUMBER

MACHINE DESCRIPTION

COLBURN No. 2 HEAVY DUTY DRILL PRESS.

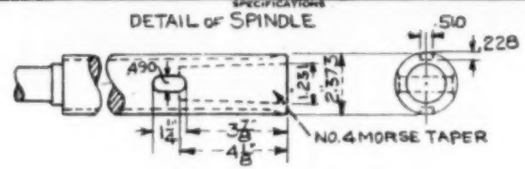
USER'S MACHINE NUMBER

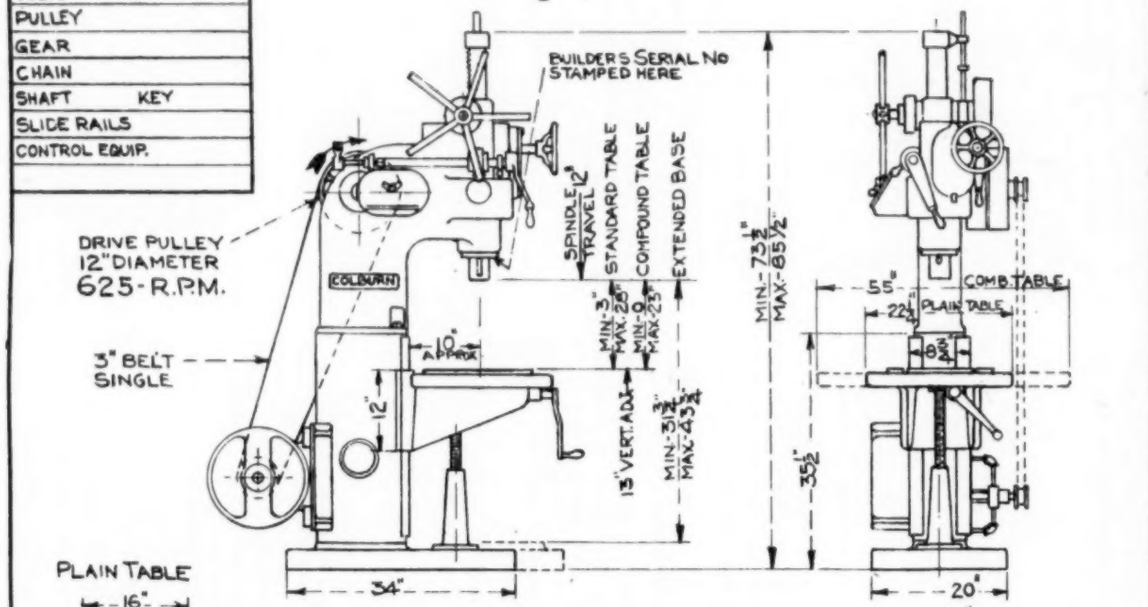
INSTALLATION

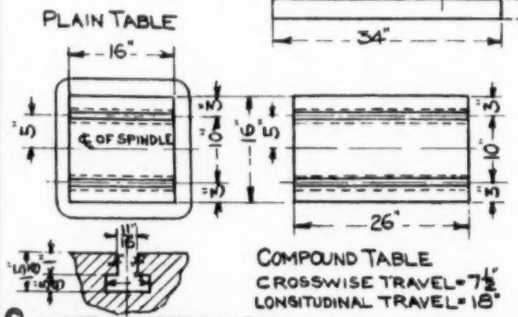
MOTOR A.C. D.C.	
SERIAL NO.	SHOP NO.
MAKE	
TYPE	FRAME
H.P. 3	R.P.M. 1200
VOLTS	PH. CY.
PULLEY	
GEAR	
CHAIN	
SHAFT	KEY
SLIDE RAILS	
CONTROL EQUIP.	

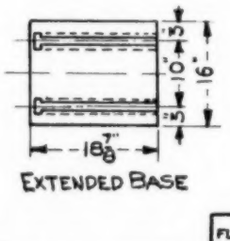
SPECIFICATIONS

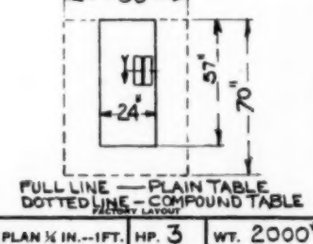
DETAIL OF SPINDLE











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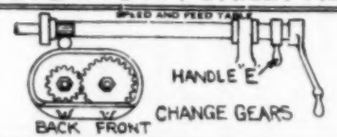
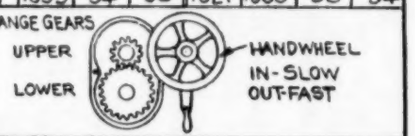


SPINDLE SPEEDS R.P.M. PULLEY 625 R.P.M.

HANDLE "E" UP	HANDLE "E" DOWN	CHANGE GEAR BACK	CHANGE GEAR FRONT	HANDLE "E" UP	HANDLE "E" DOWN	CHANGE GEAR BACK	CHANGE GEAR FRONT
74	133	21	41	283	508	41	21
80	143	22	40	264	473	40	22
86	153	23	39	246	441	39	23
91	164	24	38	230	412	38	24
98	178	25	37	215	385	37	25
105	188	26	36	200	360	36	26
112	200	27	35	188	337	35	27
119	214	28	34	176	316	34	28
127	228	29	33	165	296	33	29
136	244	30	32	155	277	32	30

FEEDS IN INCHES PER REVOLUTION OF SPINDLE

HANDWHEEL IN	HANDWHEEL OUT	CHANGE GEAR UPPER	CHANGE GEAR LOWER	HANDWHEEL IN	HANDWHEEL OUT	CHANGE GEAR UPPER	CHANGE GEAR LOWER
.005	.017	16	56				
.006	.019	18	54				
.007	.023	20	52	.049	.153	52	20
.008	.026	22	50	.043	.133	50	22
.009	.029	24	48	.038	.118	48	24
.011	.033	26	46	.033	.104	46	26
.012	.037	28	44	.030	.092	44	28
.013	.042	30	42	.026	.082	42	30
.015	.047	32	40	.024	.074	40	32
.017	.053	34	38	.021	.065	38	34



CAPACITY—
RATED SWING 20" SPINDLE TRAVEL 12"
DRILLING-1½ IN SOLID STEEL
TAPPING-10 PITCH OR FINER WITH ATTACH.
ST. 1¾" C.I. 2". PIPE TAPS-ST. 1¼" C.I. 1½"

FLOOR PLAN ½ IN.—1FT.	HP. 3	WT. 2000#	DR. BY A. L. EVANS	DATE NOV. 15, 23	DWG. NO.

FORM NO. 100

MACHINE TOOL STANDARD DATA SHEET

BUILDER'S NAME
— LUCAS MACHINE TOOL CO. —
CLEVELAND, OHIO, U.S.A.

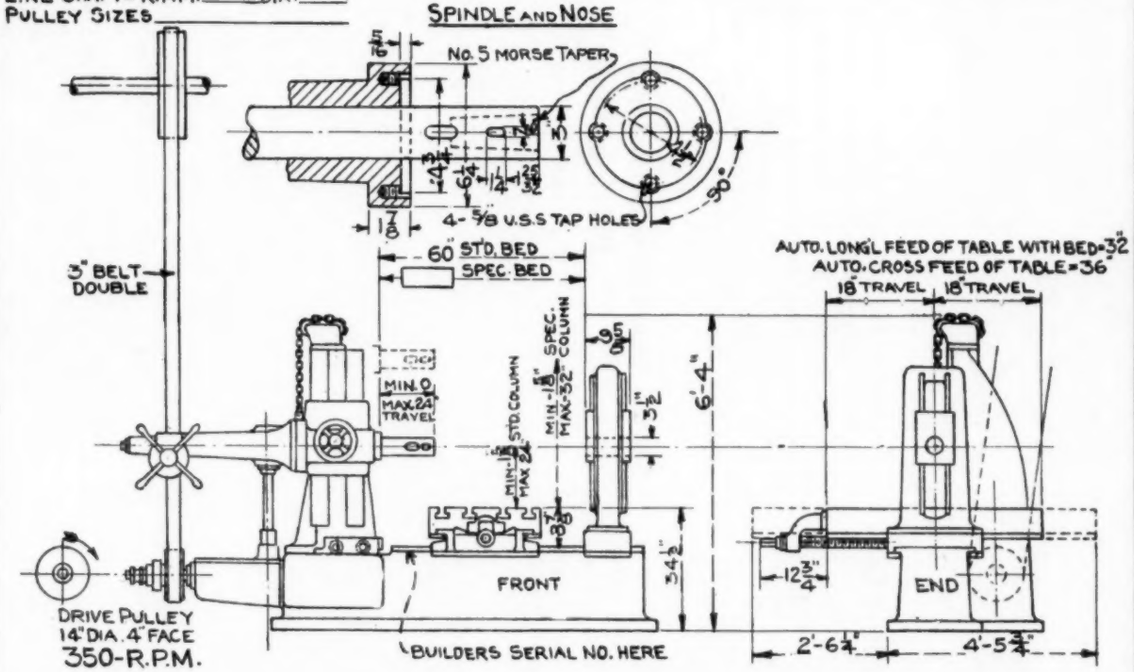
BUILDER'S SERIAL NUMBER

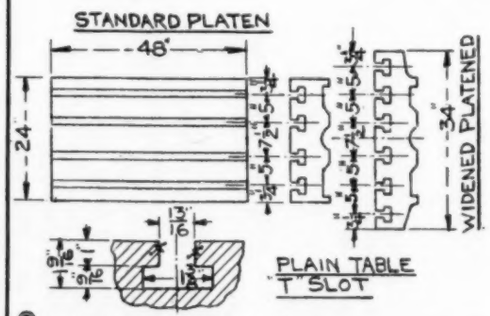
MACHINE DESCRIPTION
LUCAS No. 31 HORIZONTAL BORING MACH.

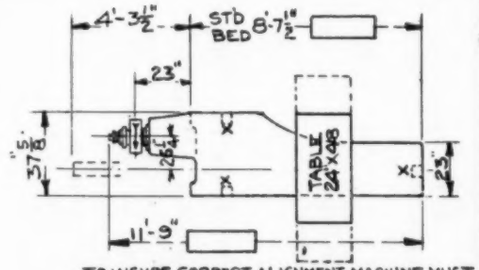
USER'S MACHINE NUMBER

INSTALLATION
LINE SHAFT - R.P.M. ____ DIA. ____
PULLEY SIZES ____

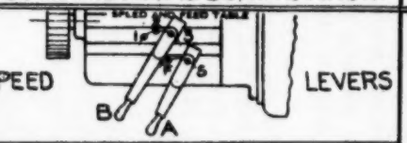
SPECIFICATIONS







TO INSURE CORRECT ALIGNMENT MACHINE MUST REST ON THE 3 POINTS INDICATED X
FACTORY LAYOUT

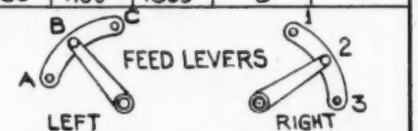


SPINDLE SPEEDS PULLEY 350 R.P.M.

COMBN	R.P.M.	POSITION OF LEVERS B	POSITION OF LEVERS A	BACK GEARS
1AS	15.0	1	SLOW	IN
2AS	19.5	2		
3AS	25.0	3		
1AF	30.0	1	FAST	
2AF	39.0	2		
3AF	50.0	3		
1BS	60.0	1	SLOW	OUT
2BS	78.0	2		
3BS	100	3		
1BF	120	1	FAST	
2BF	155	2		
3BF	200	3		

FEEDS PER REVOLUTION OF SPINDLE FOR SPINDLE, SPINDLE SADDLE AND TABLE.

COMBN	BACK GEARS OUT	BACK GEARS IN	POSITION OF LEVERS RIGHT	POSITION OF LEVERS LEFT
1A	.003	.012	1	A
2A	.005	.018	2	
3A	.007	.029	3	
1B	.011	.044	1	B
2B	.017	.068	2	
3B	.027	.107	3	
1C	.042	.164	1	C
2C	.064	.254	2	
3C	.100	.399	3	



NOTE — SPEED OF POWER RAPID TRAVERSE PER MINUTE = 97 INCHES.
ATTACHMENTS ____

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FLOOR PLAN ½ IN. — 1 FT.	H.P. 5	WT. 9000#	DR. BY A. L. EVANS	DATE NOV., 14, 23	DWG. NO.

try, the confidence of the operator is gained, which in my estimation is half the battle in time-study work.

(c) When an instruction sheet is used in connection with time study, a record can be made of the speeds and feeds used for the sub-operations. Then in setting-up the job the foreman or operator knows the lever or belt positions necessary to make the piece in the time specified. The use of data sheets in connection with time-study and instruction sheets eliminates all written instructions, and it has been proved that operators and foremen understand the data sheets much better than they understand written instructions.

MISCELLANEOUS

Among the miscellaneous advantages in having standard data sheets for all machine tools are these:

(a) When deliveries are late, special tools, jigs and fixtures can be designed and made before equipment arrives in the plant.

(b) Auxiliary tool manufacturers will derive a great benefit from these sheets, in that all guess-work will be removed from their designing. Furthermore, it will be of great assistance to them in making installations of their tools, as they will be able in a few moments to get the proper spindle speeds to obtain the cutting speeds at which they desire to run.

(c) In automobile manufacturing today it is often necessary to get axles, motors, or other parts of new design into production within a limited time. At times outside sources must be found to design and make the necessary tooling equipment. In a case of this kind, the data sheets save considerable time that would be lost in taking measurements of the machines on which the tools are to be used, and save many costly alterations when the installations are made.

Because the improvements made from time to time by the machine tool builders often have a vital effect on the information required by the user, I must mention again the importance of having the data of the individual machine tool definitely tied up to the builder's serial number. Likewise, the builder's serial number is essential when ordering repair parts.

The plan described herein has recently been adopted as a standard by the National Machine Tool Builders' Association.

It is hoped that in the near future, as new machine tool equipment is purchased, machine tool standard data sheets will be furnished by the builders, thereby eventually making it possible for every plant to have in book form a complete set of sheets covering their entire equipment.

Certain it is that there is a real need for standard data sheets in every plant and the writer can truthfully say that the metal working industry could save several million hours yearly by their use.

[Mr. Evans introduced the subject of machine tool standard data sheets to the National Machine Tool Builders' Association at its convention in Lenox, Mass., Oct. 2, 3 and 4, 1923. The convention approved the principle of standardization along the lines suggested and voted to appoint a committee who should approve the final form. The members of the committee, H. M. Lucas, of the Lucas Machine Tool Co. and E. P. Burrell of the Warner and Swasey Co., have given their approval.—ED.]

Spectral Analysis for Detecting Flaws

Increasing numbers of industries engaged in the manufacture of metal products are finding a valuable aid in the method of spectral analysis of metals which they use, and which has been developed to its present state by the spectroscopy section of the Bureau of Standards. According to W. F. Meggers, head of this section, this system offers a more convenient and rapid means of detecting impurities in metals than chemical methods. Two big New England firms, one engaged in brass and bronze manufactures and the other in silver, are making constant use of a spectograph, a device which makes this detection of various chemical elements a simple procedure. Other firms in Cincinnati, Ohio, and Buffalo, N. Y., are using the same development.

Scientists of another generation, who had knowledge of the spectra of various elements, found themselves handicapped in applying a method. Except for a small group, they left the development of spectoscopy to physicists and astronomers. Through their findings in this field, the latter were able to discover helium. Increasing knowledge in the fields of electricity and photography, however, was brought to the aid of the scientists who clung to their belief that spectral analysis of materials could be perfected. And the patient persistence of this group has been rewarded.

It was while the Bureau of Standards was engaged in researches in this science that a problem came up. A steamship had been lost by a boiler explosion. In such boilers there had been placed a safety plug which was supposed to melt at certain temperature forming one of the conditions preceding such an explosive point. The "safety plug" had apparently failed. "Why?" the Bureau was asked.

The spectrograph revealed that plugs which were supposed to be of pure tin contained a trace of lead, zinc, and other metals in some cases. Pure tin melts at a temperature of 232 deg. C. The presence of lead or zinc or other impurities caused the formation of a compound which required a very high temperature for melting. The reason was clear. Hence the spectrum analysis had been applied in a rapid and convenient manner, and an optical method could supplant a more complicated chemical test. Other experiments have proved this belief.

One Cause of Lateral Wear on Driving Boxes

BY FRANK C. HUDSON

There is considerable discussion on some roads as to the use of babbitt or brass wearing surfaces on the sides of driving boxes, to take the lateral wear. In too many cases the brass or babbitt used is about the poorest grade obtainable, and the results are not satisfactory. The Southern Pacific System, however, uses a high grade of babbitt and has good results.

One of the worst causes of wear is, in my opinion, overlooked on many roads. The amount of wear depends on the wearing surface on the driving wheels as well as on the driving boxes. Many roads are using boiler plate for hub liners, and it is very seldom one comes into the shop that is not badly scored. Boiler steel does not make a good wearing surface, and is, I believe, largely responsible for excessive lateral wear on driving boxes.

The Ford Railway uses a hardened and ground vanadium-steel hub liner, against a bronze plate on the driving box. Twenty months wear was only $\frac{1}{16}$ in. at the last report, and the plates were not scored. With a hardened plate of a good wearing metal, the lateral wear can be very much reduced. The first cost is higher than boiler plate but the results show that it saves money in the end.

Machining Sheldon Brakes, Drums and Spiders

By Fred H. Colvin
Editor, *American Machinist*

Special fixtures and tools devised for machining work of odd shape—Fixtures are shown in considerable detail so their construction can be more readily understood

THE BRAKE spider made by the Sheldon Axle and Spring Co., Wilkes Barre, Pa., shown in Figs. 1 and 2 is a malleable iron casting and weighs about 17 lb. The first operation is to face, bore and ream the inside of the hub as shown in Fig. 1. As will be seen the spider is held in a special fixture bolted to the face of the regular chuck, the usual jaws having been previously removed. The method of holding the spider in the fixture, by means of the swinging straps and the use of setscrews both for locating and clamping, are clearly shown. The facing is done from the center out and the hole is bored in the regular way.

After a 100 per cent inspection the small end is turned on the outside, this being followed by a 10 per cent inspection. Then the ends are straddle milled, a spider of different type being shown for this operation in Fig. 2. A Milwaukee milling machine is used, utilizing two inserted tooth cutters for this purpose. The fixture is very simple, consisting of a central stud or post which locates the spider square with the bore. A slotted washer and nut makes it easy to load and remove the castings from the fixture. After one end is milled, the spider is removed and reversed so that both ends are readily milled on the same fixture. It will be noted that the fixture is so arranged that the action of the milling cutter tends to raise the end being milled so that the thrust of the cut is transferred to act downward on the adjustable support at *A*.

Form Milling of Brake Cam

Another milling operation is shown in Fig. 3, where the cam which spreads the brake shoes and forces them against the inside of the brake drum, is shown. Although this fixture is double and designed for milling two cams at once, only one is shown in this set-up. The cutters mill the complete contour of the active part of the cam, the camshaft being indexed 180 deg. between operations. This result is accomplished by suitable gearing in the index head at the right.

The ends of the brake shoes are milled in the fixture shown in Fig. 4. A substantial base is provided on which the cradle carrying the shoe not only rests, but moves in line with the spindle of the machine. Suitable clamps and clamping screws are provided for holding the brake shoe firmly to its seat. With the cradle locked in the position shown, a pass of the work under the milling cutters roughs the surfaces of the face and sides of the lugs. Loosening the cradle by means of the wrench *A*, the work is moved forward until the studs *B* come in contact with stops *C*, when the cradle is again clamped. Leaving the work in this position allows the finishing cutters, which form the outer part of the gang, to finish the end surfaces with a cut which completes the milling operation. By this arrangement of milling cutters, one side of the center cutter roughs while the other side finishes.

The brake shoes then go to the Bullard vertical turret lathe shown in Fig. 5, where the ends that have just been milled are clamped against the central bar *A* in a suitable manner. This not only holds them firmly in position, but also squares them with relation to the flat surfaces milled on the ends. The straps *B* and *C* hold the shoes while being turned, so as to prevent chatter. The turning operation is simple, the sides of the rims being faced at the same time.

Brake-Shoe Inspection Gage

A simple inspection gage for the brake shoes is shown in Fig. 6. It consists of a substantial base having the seats *A* and *B*, planed to receive the milled ends. The three pins shown, properly located, form a "go" gage which is easily made sufficiently accurate. This gage allows very rapid inspection.

After this inspection the holes are drilled, and reamed where necessary, and the small holes for holding the brake lining are also drilled. No fixture is used for the latter operation, the workmen soon becoming sufficiently skilled to drill them near enough to the desired position.

The brake drum is a sheet-steel stamping and is turned, bored and faced on the Gisholt lathe shown in Fig. 7. The shape of the chips which curl up on the boring tool give some idea of the quality of the steel used. The holes through which the drum is bolted to the wheel are then drilled under a multiple-spindle drilling machine, as shown in Fig. 8. The drills are guided by drill bushings in a steel plate placed inside the drum, as can be seen. The handle *A* makes it easy to remove the bushing plate after the holes have been drilled.

Drill *B*, of a larger diameter, is located apart from the others and is used for slightly countersinking the bolt holes before the drum leaves this machine. No fixture is used, the operator simply turning the drum until each hole has been countersunk.

Another milling operation in connection with the

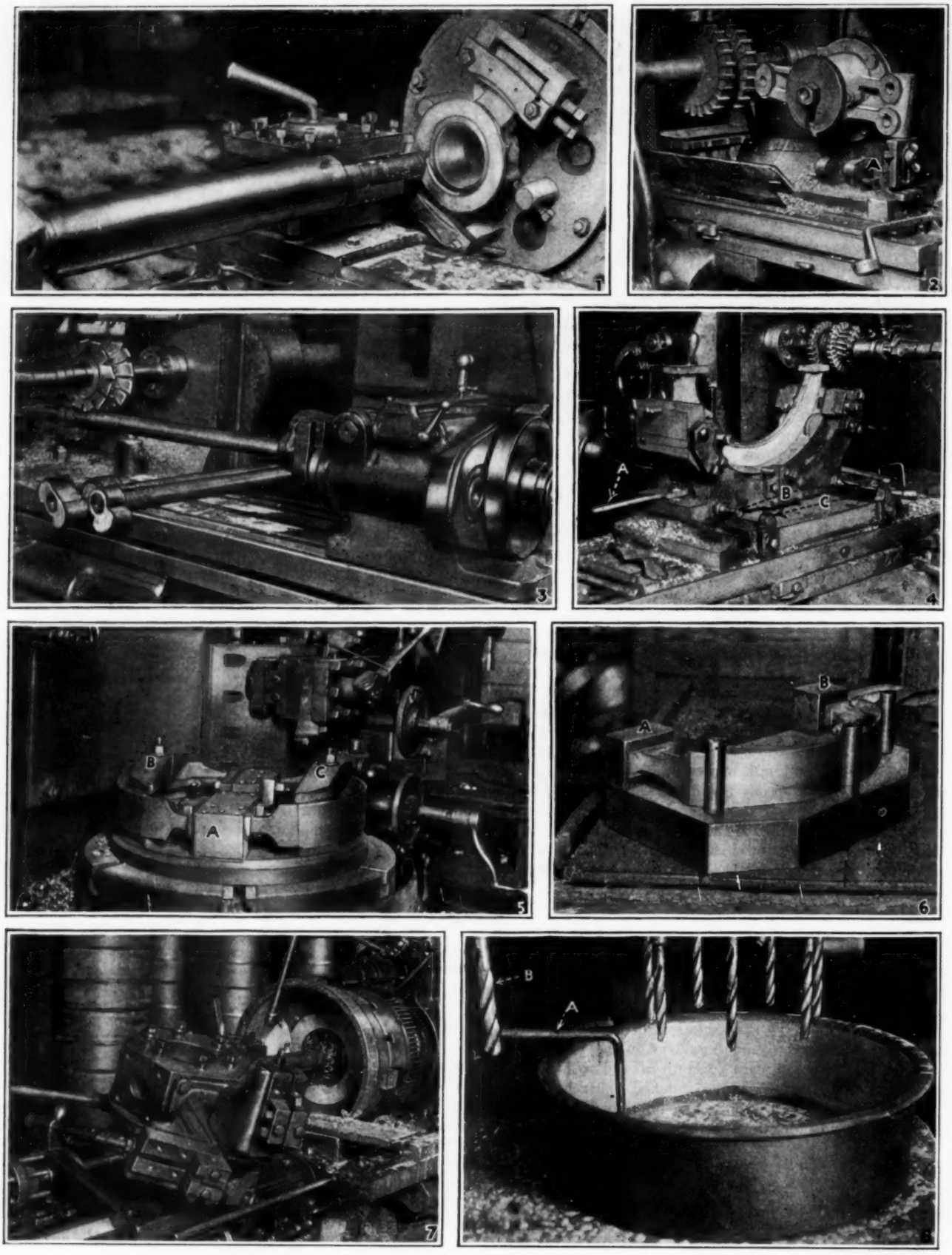


Fig. 1—Turning and boring brake spider. Fig. 2—Straddle milling end of spider. Fig. 3—Form milling brake-shoe cam. Fig. 4—Milling fixture for brake-shoe cam. Fig. 5—Turning outside of brake shoe. Fig. 6—Inspection gage for brake shoe. Fig. 7—Turning, boring and facing brake drum. Fig. 8—Drilling and countersinking holes in drum

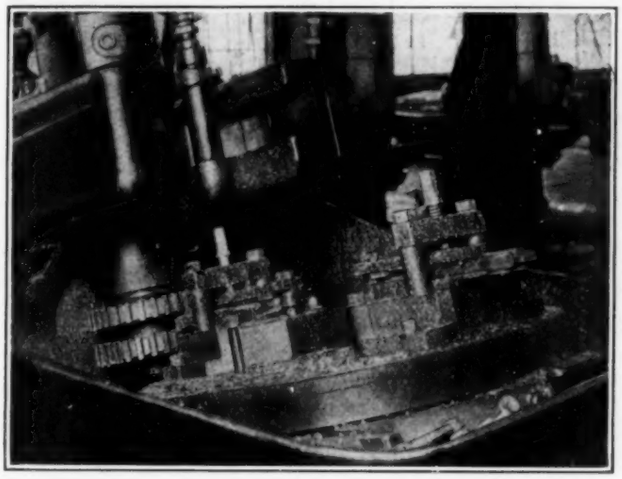


Fig. 9—Continuous milling of brake links

brake rigging is shown in Fig. 9. Here an Ohio tilted milling machine is being used for straddle milling the ends of links used in connection with the brake rigging. This machine has the usual rotating table which always has a loading station convenient to the operator.

The Plan for Mobilizing Industry —Discussion

BY E. C. OLIVER
President, Oliver Instrument Company

IF IT IS a fact that a trained army can be placed on a fighting front a year earlier than American made munitions can follow them, it would seem that there is a great opportunity for improvement in the peace time occupation of engineers and others whose duty it is to keep the country in a state of preparedness and avoid the unpardonable offense of being "surprised."

It would not be possible to mobilize an army and get them on the fighting front if each captain, after being put in command of a company, found it necessary to formulate a method of drilling, originate and teach commands and devise a manual of arms. These and many other things are already formulated for him and he is not permitted to deviate materially from them. If industry is to be mobilized, something of a similar nature must be worked out and standardized in order that they may be able to keep step with the army.

During the late war it was the consensus of opinion that manufacturing was hampered to a great extent by needlessly strict inspection. However, results would indicate that it was still further and more seriously hampered by lack of standardization in manufacturing methods. Practically every firm that had a contract for the manufacture of a war article was previously engaged in making an entirely different product and the engineers, whose duty it was to plan the manufacture of munitions, had little or no training along this highly specialized line. As a consequence, each factory used different methods in accomplishing the same results.

To illustrate this, a certain firm that was highly efficient in the manufacture of their own product, took a contract for the manufacture of shells. The forgings were furnished them but practically every operation was much different from what they were used to and they had much difficulty in making a piece of work which would pass inspection. Assistance was obtained from another plant where similar work was being done and after much loss of time a passable product was made. These people designed a machine for setting the copper bands and it took several trials before this machine worked in a satisfactory manner. They also had considerable trouble in the turning of copper bands and there were many rejections for undersized bands and imperfections in turning.

It was proposed to form mill the bands as was being done at another plant in order to reduce the undersized rejections. This milling was taking somewhat over ten minutes a piece, but about this time an employee suggested making an under cutting tool for a turret lathe and when this was done the bands were turned in considerably less than one minute with a fine finish and no rejections. Here were three ways of accomplishing the same job, one of which was by far the best but it was necessary to try all three in order to determine the proper method.

A YEAR OF EXPERIMENTING

Another plant making adapters spent nearly a year experimenting with various tools and methods before they could make parts which would pass inspection and when finally they were able to produce a passable product there was no further need for the parts.

American manufacturers pride themselves on being versatile and adaptable and no doubt they did as well as could be expected under the existing circumstances. However, in most cases the cost of manufacture was considerable higher then necessary and the experiments and delays were still more costly.

It would not be prohibitive from a financial standpoint and it would pay immense dividends if another unpleasantness should take place, if this Government should establish a sort of experiment station in the form of a small factory for the manufacture of such articles as are used in immense quantities, such as shells, adapters and similar parts. We use the word manufacture in its commercial sense because nothing short of intensive manufacturing would bring out the information that such a factory would produce and, as a matter of fact, information would be the really desirable and valuable product of such an institution. The shells or other material would be a by-product.

A PLACE FOR REAL PRODUCTION ENGINEERS

This factory should be in charge of real production engineers, able to make a careful study of manufacturing methods as applied to a particular article. They would select the proper machines and proper tools and operate the plant for maximum production, establishing piece work prices and in every way imitating war time operation. A time study should be made of every operation with a view of obtaining the best possible methods and best possible tools. The engineer in charge should be afforded every opportunity to work with machine tool manufacturers or others in producing special machines which might be necessary in the processes and when this engineer came to the conclusion that he had reached the ultimate limit of possibilities in speed and efficiency, another one should be chosen for his ability, and given instructions to increase the production of the plant at least 20 per cent with the same man power. This method taken seriously and adhered to over a considerable length of time will bring to light the most

economical methods and the most useful and accurate tools which can be devised.

If this information is carefully compiled it will have two results; first, if limits are needlessly severe and it is found impractical to manufacture parts to these limits, tests can be made by actual trial of the product to find the result of using parts having commercial tolerances. If it is found that a shell, for instance, will travel as accurately with certain allowances, then these allowances should be made, but on the other hand, if it is found that close limits should be maintained in order to get the result desired, then our engineers are up against the problem of producing tools which will give the degree of accuracy desired *and on a production basis.*

When this plant has been operated a certain length of time to satisfy those particularly concerned that they have absolutely standardized the method of making the product, then all the data should be collected in the form of a printed book and this book would contain drawings, showing the most desirable layout for plants of various sizes, the most desirable machines for certain operations, the proper tools and method of adapting them to various types of machines and complete descriptions of processes. It would contain drawings of any special machines, jigs, holding devices, etc. It would also contain time studies of various operations for men and machines, so that there would be no question as to the possible production of a given shop containing a certain line of machines, and employers would have specific information as to the number of employees necessary and the best possible arrangement of machines.

We would go even further than this because if some special operation required a tool which in turn required tools for its production, these tools could be carried on hand and much time saved in obtaining the desired tool. For instance, if the under cutting method for copper bands was decided on as being the best possible for this operation, then milling cutters for producing these under cutting tools could be made up and carried, and should occasion arise, a few cutters would produce in a week all the under cutting tools which could be used. The same would be true of special machines—complete sets of metal patterns and possibly some jigs could be carried and months saved in producing them.

Perhaps some of these patterns, jigs or tools might be obsolete when they are required but if "it is not pardonable to be suprised" then it is not pardonable to permit them to become obsolete. Our book of instructions would be revised as often as an improvement occurs. This would necessitate the almost continuous operation of our high pressure factory.

If occasion should arise necessitating the production of munitions rapidly, the information compiled and properly arranged in this book of instructions could be given to a manufacturer and he could proceed with his contract with the absolute knowledge that he was using the very best methods possible for the production of his article. No experimenting would be necessary and delays, rejections and waste would be reduced to a minimum.

Speed and Feed Tables for Drilling Machines

BY L. M. FRANCIS

In the use of modern high-speed drills, unless the operator is given definite instructions or provided with tables, the speeds and feeds are likely to be much less than the tools are capable of standing. Good high-speed drills will stand being forced far beyond what appears to the casual observer or uninformed operator to be reasonable.

As a guide to operators and supervisors, it is desirable to have a table attached to each drilling machine showing just what speed and feed may be used with safety for any size of drill within the capacity of the machine. Such tables are easily prepared to meet any required set of conditions by using the operating recommendations of the drill makers as a basis.

On most modern drilling machines, especially of the radial type, there is usually to be found a metal plate giving the number of spindle revolutions per minute for the different gear positions and the various rates of advance per revolution of the spindle for the several feed adjustments. On belt-driven machines the number of spindle revolutions per minute, corresponding to the different steps of the cone, may be ascertained quite easily, and the rate of feed may be determined by measuring the advance of the spindle over a given number of revolutions.

Two speed and feed tables are shown herewith. Table I is merely a copy of the drilling specifications supplied for use in connection with a certain gear-driven machine, while Table II is made to correspond with the range of speeds and feeds of an older machine of the belt-driven type.

Table I—Drill Speeds and Feeds for Gear-Driven Machines

Size, Drill	Speed—Steel	Speed—C.I.	Feed
1/4	458	610	0.007
3/8	366	459	0.011
1/2	305	383	0.011
5/8	262	328	0.015
1 in.	229	287	0.015
1 1/8	204	255	0.015
1 1/4	183	229	0.015
1 1/2	153	191	0.015
1 3/4	127	164	0.015
2 in.	104	143	0.015
2 1/4	89	118	0.015
2 1/2	76	106	0.025
2 3/4	68	95	0.025
3 in.	60	84	0.025

Table II—Drill Speeds and Feeds for Belt-Driven Machines

Gear	Speed	R. P. M.	Size Drill—Steel	Size Drill—C. I.	Feed
Back Gear In	Low	15			
	2nd.	25			
	3rd	40			
	High	58	2 1/2		0.023
Back Gear Out	Low	80	1 7/8 —2 1/4	2 1/8 — 2 1/2	0.017
	2nd	130	1 1/8 —1 3/4	1 1/4 —2	0.017
	3rd	210	3/4 —1 1/16	1 —1 3/16	0.010
	High	310	1 1/16 and under	1 3/16 and under	0.010

The Graphical Solution of Helical Gear Problems

By Franz Szabo

A method for investigating the characteristics of helical gearing—Approximate solution to the problem easily obtainable—Trial calculations eliminated—Method adapted to all conditions

VALUABLE data for making helical gear calculations have been published from time to time, taking the reader through considerable though necessary mathematics; but not much has been written regarding the graphical solution of these problems. Many of them, of course, can be solved readily by mathematics; but there are some the solution of which requires a number of tedious trial calculations before the correct answer is arrived at; for example, to find the tooth helix angles and the radii of a pair of helical gears when the speed ratio, the normal diametral pitch and the center distance are known, with the shafts at some angle to each other. Problems of this kind are solved with a considerable saving in time by employing the graphical method outlined in this article, or the results are at least accurate enough to eliminate nearly all trial calculations.

The purpose of this article is not to do away with the mathematical solution of helical gear problems, nor to recommend any specific tooth helix angle for a set of given conditions; but merely to eliminate most of the preliminary tedious trial calculations where such are necessary, and to reveal, or make at once known by means of diagrams, rules and conditions otherwise not easily seen beforehand. The reader must, in using the graphical method, consider the tooth helix angles with respect to direction of rotation, and direction and magnitude of end thrust of the gears to see if they are practical, the same as when making calculations.

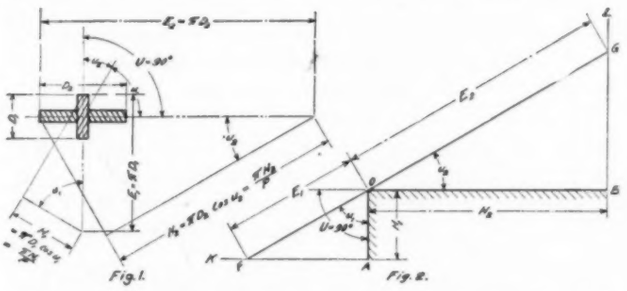


Fig. 1—Layout of helical gears with shafts at right angles. Fig. 2—Method of constructing chart from Fig. 1

The writer is well aware of the fact that the term "spiral gear" is commonly employed, although it is a misnomer; therefore, the terms "helical" and "helix" are here used. In employing the graphical method outlined in this article, all diagrams should for best results be drawn full size or to some scale, the larger the better, and as accurate as possible, and all resulting measurements must be read to the same scale as the one used for making the diagram.

Unless otherwise specified, the following symbols are used throughout this article:

C = Center distance between the two shafts, inches
D_1 = Pitch diameter of driver, inches
D_2 = Pitch diameter of follower or driver, inches
E_1 = Circumference of pitch circle of driver, inches
E_2 = Circumference of pitch circle of follower, inches

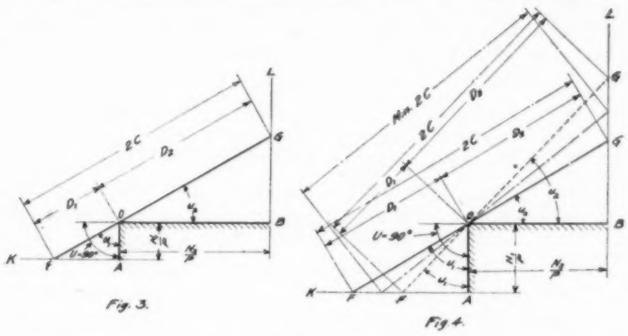


Fig. 3—Graph for shafts at right angles. Fig. 4—Possible solutions for shafts at 90 degrees

H_1 = Length of normal helix of driver, inches
H_2 = Length of normal helix of follower, inches
N_1 = Number of teeth of driver
N_2 = Number of teeth of follower
P = Normal diametral pitch.
U = Angle between shafts, degrees
u_1 = Tooth helix angle of driver, degrees
u_2 = Tooth helix angle of follower, degrees

In Fig. 1 is shown a pair of helical gears with shafts at 90 deg. to each other. Upon each gear is drawn a triangle having angles u_1 and u_2, which are the tooth helix angles of the gears. The hypotenuse of each triangle represents the circumference of the gear to which it belongs, E_1 and E_2 respectively, while the side adjacent represents the respective normal helix H_1 and H_2. It is apparent that when the number of teeth and the center distance have not been fixed it is an easy matter to calculate pitch diameters D_1 and D_2 and the center distance C by selecting a suitable tooth helix angle u_1 for the driver. Let us now make a graphical layout of the case just considered.

In Fig. 2 draw line OA in length equal to H_1, the length of the normal helix of the driver, and OB in length equal to H_2, the length of the normal helix of

the follower, *OA* and *OB* to form the angle *U*, the angle between the shafts or 90 deg. in this case. In this instance the angle *U* could have been shown as being the included angle *AOB*, but further on it will be shown that Fig. 2 shows the correct method for indicating the angle between shafts. Upon *OA* and *OB* erect verticals *AK* and *BL*, respectively. A straight line *FOG* is then drawn through *O*, forming the angle u_1, the tooth helix angle for the driver with *OA*, and intersecting *AK* and *BL* at *F* and *G*, respectively. Distance *FO* will then indicate the circumference E_1 of the driver

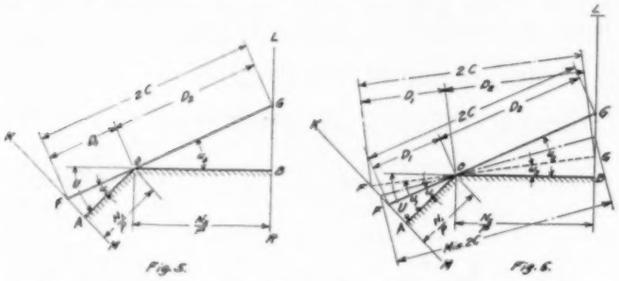


Fig. 5—Graph for shafts not at right angles. Fig. 6—Possible solutions for shafts not at right angles

while *OG* gives the circumference E_2 of the follower.

In order to let *FO* and *OG* represent diameters instead of circumferences, it is necessary to make the lengths *OA* and *OB* equal to $H_1 \div \pi$ and $H_2 \div \pi$ respectively, as shown in Fig. 3. Since $H_1 = \pi N_1 \div P$, and $H_2 = \pi N_2 \div P$, it follows that $H_1 \div \pi = N_1 \div P$ and $H_2 \div \pi = N_2 \div P$. The sum of D_1 and D_2 is twice the center distance between the gears, or 2*C*.

When the center distance is fixed and the normal diametral pitch has been decided on, this same method will quickly show what number of teeth to select and what the tooth helix angles will be. Draw lines *OA*, *OB*, *AK* and *BL* the same as before, making *OA* equal to $N_1 \div P$, and *OB* equal to $N_2 \div P$. Place a scale on the diagram so that the edge of the scale passes through the center *O*, adjust the position of the scale until the distance *FOG* measures twice the center distance between the gears, and mark points *F* and *G*. Distance *FO* is then the pitch diameter of the driver and *OG* is the pitch diameter of the follower. Angles u_1 and u_2 are the tooth helix angles of driver and follower, respectively.

It must be remembered, however, that in case line *FOG* is of such length as to intersect *AK* and *BL* when pivoting it about center *O*, there are always two answers possible for u_1, u_2, D_1 and D_2 with a fixed length for *FOG*, as shown in Fig. 4. The full line *FOG* shows one, and the dotted line shows the other result, both being of the same length. Find both solutions and select those angles for u_1 and u_2 which are most suitable. If on following this method it is found that twice the center distance between gears is too short to form the straight line *FOG;* it shows that the values $N_1 \div P$ and $N_2 \div P$ are too great. Select a smaller number of teeth for both the driver and follower, but keeping the ratio $N_1 : N_2$ the same, and try again. If twice the center distance or *FOG* is long enough to reach *AK* and *BL* when passing through center *O* and neither of the two solutions for u_1 and u_2 is satisfactory, change the number of teeth again, preserving the ratio $N_1 : N_2$ until the solution is satisfactory.

If conditions are just right, line *FOB* representing twice the fixed center distance will be just long enough in a certain position to touch lines *AK* and *BL* when passing through the center *O*, and any pivoting of the line about *O* will make this line too short for a solution. In this case only one answer is possible, and it is indicated by the dotted line marked "Min. 2*C*" in Fig. 4. Only one "Min. 2*C*" is possible for each ratio $N_1 : N_2$.

One fact is revealed in the Figs. 2, 3 and 4; that is, a spur gear can be employed neither as driver nor as follower when the angle *U* between shafts is 90 deg. This is at once clear when we remember that the spur gear has zero angle for the tooth helix, since the teeth are parallel with the axis of the shaft; and it is impossible to make line *FOG* reach from line *AK* to line *BL*, passing through the center *O*, with either angle u_1 or u_2 zero.

The following rules are also clearly shown by the diagrams in Figs. 2, 3 and 4, namely: When the angle *U* between shafts is 90 deg., then this angle is the sum of the tooth helix angles, or $U = u_1 + u_2$; and the helix in both gears is of the same hand, either right or left, but never opposite. That the helices in this case are always of the same hand is indicated by the position of line *FOG* with respect to angle *AOB*. With the whole length of line *FOG* on the outside of angle *AOB* and no part of it passing through the shaded side, the same hand of the helix, either right or left, is indicated. This condition will be better understood further on.

When the angle *U* is other than 90 deg. the graphical method is used in similar manner. In Fig. 5 draw line *OB* in length equal to $N_2 \div P$; likewise draw *OA* in length equal to $N_1 \div P$, making angle *U* equal to the angle between the shafts. In this example it is apparent that the angle *U* between shafts could not be represented by the included angle *AOB*, which has been

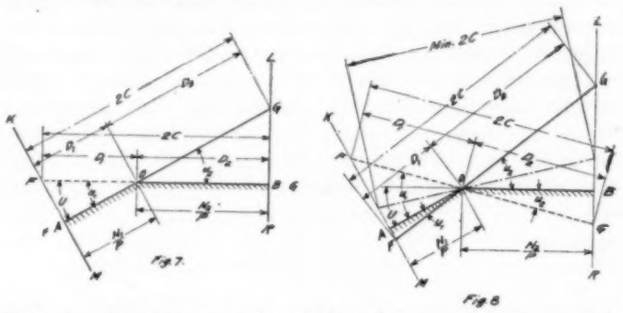


Fig. 7—Appearance of graph when one spur gear is used. Fig. 8—Helix angles of the gears are opposite in this case

pointed out previously. At *A* and *B* erect verticals *KM* and *LR*, respectively. Selecting a suitable value for u_1 and drawing the line *FOB* through the center *O*, D_1 and D_2 will represent the pitch diameters of driver and follower, respectively.

If the center distance between the gears is fixed and the normal diametral pitch has been decided on, the angles u_1 and u_2 may be found by placing a scale on this diagram with its edge passing through center *O*, and then moving the scale about *O* until the length *FOG* equals twice the center distance. Here again two answers are possible for u_1, u_2, D_1 and D_2, except when twice the center distance is too short to reach from line *KM* to line *LR* when passing through *O*, or when the conditions are such that 2*C* is minimum, as indicated by "Min. 2*C*" in Fig. 6.

If $2C$ is too short for FOG or the resulting values for u_1 and u_2 are not suitable, change values $N_1 \div P$ and $N_2 \div P$ while preserving the ratio $N_1 : N_2$, by changing either the number of teeth or the diametral pitch. Change lines OA and OB to the new values, then repeat the procedure until satisfactory results are obtained.

In a pair of helical gears having a shaft angle other than 90 deg., especially if the angle U is comparatively small, it is possible to have the hand of the helices either the same, right or left, or to have one gear a

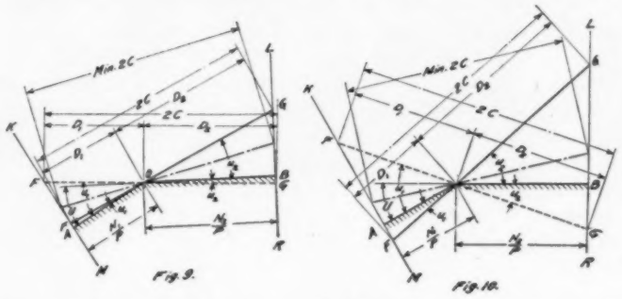


Fig. 9—Helices of these gears will be of opposite hand in one solution only. Fig. 10—Helices will be of opposite hand in both possible solutions

spur gear and the other a helical gear with right- or left-hand helix. It may be difficult to visualize these possibilities at first, but the diagrams prove this statement readily. Figs. 5 and 6 show that the whole length of the line FOG is on the unshaded side of the angle AOB, of course, passing through the center O. This condition, as stated before, indicates that the helices of both gears are of the same hand, either right or left.

By decreasing angle u_1 and consequently increasing angle u_2, we gradually decrease length FO, the pitch diameter D_1 of the driver, until FO equals or coincides with AO. When this is the case, then D_1 equals $N_1 \div P$ and is the pitch diameter of a spur gear since u_1 is then zero, and the angle u_2 is then the same as the angle U between shafts, as shown in Fig. 7. Instead of making the driver a spur gear, we may make the follower a spur gear by decreasing angle u_2 to zero, in which case OG or D_2 equals $N_2 \div P$, and u_1 equals U. When one of the two gears is a spur gear, the helix angle of the other gear may be either right or left hand.

With shafts at an angle other than 90 deg., another condition is possible. Suppose we do not stop when angle u_1 is zero, but continue rotating line FOG about center O until it has the position shown by the full line in Fig. 8. In this case the portion FO is on the shaded side of AO forming angle u_1 and portion OG is on the unshaded side of BO forming the angle u_2. This arragement indicates the helix angles of the gears to be of opposite hand, and shaft angle U equals $u_2 - u_1$. Or we may draw OG on the shaded side of OB and FO on the unshaded side of AO, as shown by the dotted line in Fig. 8, this arrangement also resulting in opposite hand helices, but U equalling $u_1 - u_2$.

The foregoing shows that when drawing the angle u_1, line FO may be drawn on either side of AO and results either in helices of opposite hand regardless of whether drawn on the shaded or unshaded side of AO, when u_1 is greater than U; or in helices of the same hand when FO is on the unshaded side of AO, and of opposite hand when FO is on the shaded side of AO, when u_1 is smaller than U.

Examining Fig. 8 more closely, we will notice, although not shown by lines, that when the center distance between shafts is not fixed, by making the helices of opposite hand the line FOG and consequently the pitch diameter and center distance may be considerably greater than when making the helices of same hand with the tooth helix angle remaining the same. This possibility may be a factor in deciding whether to use the larger or the smaller resulting pitch diameter D_2 for the large gear of the pair. With the center distance fixed and the diametral pitch decided on, the numbers of teeth in the gears may be changed until the tooth helix angles u_1 and u_2 are satisfactory, and the diagram may be used the same as with a 90-deg. shaft angle. Here again, if FOG representing twice the center distance is too short for the diagram, values $N_1 \div P$ and $N_2 \div P$ are too great and must be reduced. Also, there are in this case two answers possible for every value of $2C$ except when this value is "Min. $2C$" as shown in Fig. 8, in which case the helix angles are of the same hand. When angle u_1 or u_2 with the angles on both gears of the same hand and fixed center distance in one possible answer is very small, then the angles of the gears in the other possible answer are of opposite hand, as in Fig. 9; but, when this angle is greater than U or when $2C$ is comparatively much greater than "Min. $2C$," then the helices are of opposite hand in both possible answers, as shown in Fig. 10.

The foregoing Figs. 5 to 10 inclusive indicate the following rules for a pair of helical gears with shafts at an angle other than 90 deg.:

(1) In a helical gear drive the helix angle of the teeth may be of the same hand for both gears, either right or left; they may be of opposite hand, either one of the

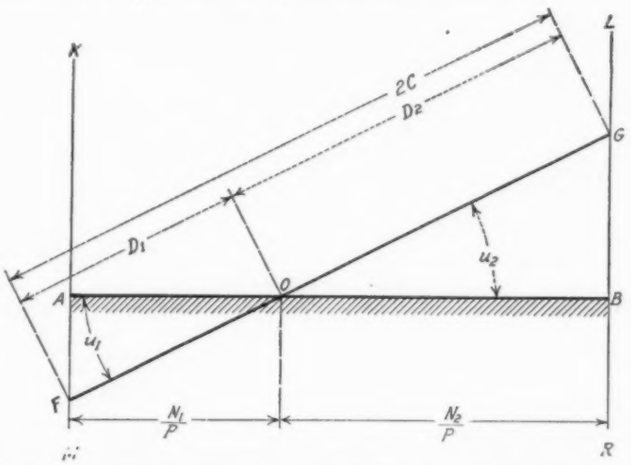


Fig. 11—Shafts are represented parallel in this graph

pair right and the other left; or one gear of the pair may be a spur gear and the other a helical gear with a helix angle either right or left hand.

(2) When U is greater than u_1, then $u_2 = U - u_1$ and the hand of the helices may be same or opposite; when U is smaller than u_1, then $u_2 = u_1 - U$ and the hand of the helices for the gears is always opposite; with U equal to u_1 or u_2, one of the gears is a spur gear and the other a helical gear with either a right- or left-hand helix.

Having thus disposed of helical gears with shafts at some angle to each other, it may be interesting to know

how the graphical method works with such gears having shafts parallel to each other. In this case the shaft angle U is zero, and AOB is consequently a straight line as shown in Fig. 11. After drawing AOB erect verticals KM and LR. With center distance, not fixed but u_1 and P decided on, draw line FOG. D_1 and D_2 are then dependent upon N_1 and N_2. It will be at once apparent that when U is zero, $u_1 = u_2$ and the helix angles are always of opposite hand. With the center distance fixed, pivot FOG of fixed length about O until the ends touch lines KM and LR. Then angle $u_1 = u_2$ and is the tooth helix angle on both gears. Needless to mention, if length $D_1 + D_2$ or twice the center distance equals $(N_1 \div P) + (N_2 \div P)$, we have a pair of spur gears.

In all diagrams of this article the length of the normal helix for the driver, AO, is shown shorter than that for the follower. However, it is not to be construed to mean that this condition necessarily should be so. Since the driver frequently has more teeth than the follower, it follows in that case that AO on the diagram will be longer than OB. Also, the hand of the helix angle to be used, whether left or right, is not indicated by the diagrams; this point must be determined by the direction of rotation of the gears and direction of end thrust. The diagram does show whether the angles are of same or of opposite hand.

Although this article is supposed to deal only with the graphical method, a few words regarding the mathematical solution for "Min. $2C$" will not be out of place. When the angle U between shafts is 90 deg., the tooth helix angle u_1 when $2C$ is minimum is expressed by the formula

$$\tan u_1 = \sqrt[3]{\frac{N_2}{N_1}}$$ which is derived as follows:

$$2C = \left(\frac{N_1}{P}\right) \sec u_1 + \left(\frac{N_2}{P}\right) \operatorname{cosec} u_1.$$

When $2C$ is minimum, the derivative

$$\frac{d(2C)}{du_1} = \left(\frac{N_1}{P}\right) \tan u_1 \sec u_1 - \left(\frac{N_2}{P}\right) \cot u_1 \operatorname{cosec} u_1 = 0,$$

From this, $$\frac{\left(\frac{N_1}{P}\right) \tan u_1 \sec u_1}{\left(\frac{N_2}{P}\right) \cot u_1 \operatorname{cosec} u_1} = 1.$$

Transposing and canceling,

$$1 = \left(\frac{N_1}{N_2}\right) \tan^3 u_1 \quad \text{and} \quad \tan u_1 = \sqrt[3]{\frac{N_2}{N_1}},$$

which is the value desired.

Also, $$\tan u_2 = \sqrt[3]{\frac{N_1}{N_2}}.$$

Then, Min. $$2C = \frac{N_2}{P \sin u_1} + \frac{N_1}{P \cos u_1}.$$

When the angle U between shafts is other than 90 deg., then "Min. $2C$," there apparently being no formula for this condition available, must be determined by trial, using various values for u_1 until the value $2C$ is minimum in the following formula:

$$2C = \frac{N_1 \sec u_1 + N_2 \sec (U - u_1)}{P}.$$

Here is where the graphical method is of advantage.

The graphical method outlined in this article may at first seem complicated; but once the principle is understood, it is easy to see most of the possible conditions shown by the diagrams in one's mind, even without drawing the diagrams.

Getting the Most Out of Reading Matter

By A. J. Beatty
The American Rolling Mill Co.

"HAVE YOU read Mr. Edison's article in last week's *American?*" How often have we all read some valuable article or book that would have entirely escaped us, if some one had not told us of it by such a question as this.

"Fifteen Minutes a Day," devoted to the much-advertised "Five Foot Book Shelf" is said to "guarantee" a thorough, general education to those who conscientiously follow this slogan. The American Rolling Mill Company is using a similar and very effective device that serves the more specific purpose of directing the men of its organization to general and technical articles worth reading or, better still, specially applicable to their jobs. The plan has two distinct services: The Armco Worth Reading Bulletin, and the Magazine Exchange. The Worth Reading Bulletin is the subject of this article, the Magazine Exchange will be described in a later article.

The idea of the Armco Worth Reading Bulletin originated in a continuous stream of questions that used to come and still continue to come to the Training Department from the live foremen and other young men of our plant who had been enrolled in our foremanship classes. They wanted something to read along the lines of the foremanship discussions, or relating to some of the technical phases of their jobs.

A Clearing House for Articles

One foreman wrote: "Could your department conduct a sort of clearing house for articles worth reading? If every live foreman would reciprocate with the titles of valuable articles that he has read either in current periodicals or in books, it would doubtless help us all. What do you think?"

No organization can afford to disregard such requests and suggestions, especially if its processes depend to a large extent upon accurate, technical knowledge. Furthermore, such requests are also important as a barometer of the progressiveness of the organization as well as a specific indicator pointing out the "comers" for the future. The first Bulletin was issued on April 13, 1922, and is reproduced here. When it was issued, there was little thought that it would grow to its present importance as a publicity and an education factor.

"AS FOREMAN IS, SO IS THE PLANT"

The article under the above title, in the *Iron Trade Review* of March 23, 1922 (pp. 820-22), under the names of C. R. Hook, E. A. Holbrook, and Arthur Notman, is a special review of the training of foremen, and is of particular interest to all Armco men. It's worth reading.

TRAINING DEPARTMENT

The real worth of the Bulletin is best shown by the following sample titles of articles or topics that have been cited or discussed:

"Why Men Fail."

"Two Fakes to Fear, 'Bucket Shops' and 'Quack Doctors'."

"How Carnegie Dealt With His Men."

"The World's Six Greatest Men."

"What Will the Next Ten Years Bring in Steel?"

"How the Railroads Spend Their Money."

"Better Transportation."
"Why We Pay 30 Per Cent Too Much for Our Coal."
"Ten Commandments for Foremen."
"Industry's Handicap of Fear."
"Hardness and Hardening."
"Shall We Find the Oil We Need?"
"Refractories in the Steel Industry."
"What is an Executive?"

The original mailing list contained the names of one hundred men, mostly foremen who had earned certificates in our foremanship class. It has grown until it now comprises practically every foreman and subforeman in the home plant and outlying plants, and the staff in our district sales offices. It is also being sent to a large number of our correspondents who have asked to be placed on the mailing list.

"Does the Bulletin pay?" "Do you read the articles cited?" "Do you want the Bulletin continued?" All these question and several more were sent out as the subject matter of one issue after the Bulletin had passed the experimental stage. Only a single return came back with an unfavorable reply. We are therefore convinced that the Worth Reading Bulletin has earned and made itself a permanent place among our training activities.

Combatting the Noisy Minority—Discussion

BY C. O. SANDSTROM

The editorial, "Combatting the Noisy Minority," on page 150, Vol. 60 of the *American Machinist* calls attention to a condition that is fast becoming unbearable. As is well known, the machinery of legislation is largely in the hands of pettifoggers to whom oratory is the *ne plus ultra* of earthly things, and to whom business is but a cow to be milked and to be harrassed for the purpose of self-aggrandizement. On reading the output of a session of congress one is impressed as was Hamlet when asked what he was reading. His reply was, "Words, words, words."

Any young man who likes to talk feels the "call" of law or politics. That there may be other qualifications does not seem to enter into consideration and, judging from the output of legislative bodies, there is none, or at best of little comparative importance.

Oratory should be regarded as strictly one of the arts —an appeal to the emotions. Its effect on the welfare of the country has often been pernicious. It has no useful place in business, and when it is invoked in business the net result is that somebody has bought something he didn't really need. Emotionally we are a million years old—intellectually we are in our swaddling clothes.

GENESIS OF THE "NOISY MINORITY"

There is nothing inexplicable about the genesis of the "noisy minority," or the "fighters" that are continually making asses of themselves in the halls of legislature. We have always had them. They are primarily neurotics and egotists. They are incapable of teamwork in subordinate positions. At a wedding they must be the bride—at a funeral, the corpse. We can all remember as boys the lad who owned the ball or the bat. He would dictate the position he would play. The fact that he couldn't pitch didn't matter. He *would* pitch or he'd take his ball (or bat) home, and there would be no game. This lad is now in congress and he is running true to form. He *will* pitch or he will take his ball and go home—he is an insurgent.

Many years ago Herbert Spencer wrote a letter on "Government by Minority" that should commend itself to all thinking men and which is of special interest at the present time. He wrote:

> Amid minor political issues occupying all minds the major political issue passes unnoticed.
>
> The major political issue is — shall we maintain the supremacy of majorities? While in theory asserting it more emphatically than ever, we are in practice meanly relinquishing it. The very moment after we have extended the system of government by majority outside the House, we are tacitly allowing the system of government by minority inside the House. We are helplessly looking forward to the coercion of two great parties by one small party.
>
> Right feeling alone, or moderate intelligence alone, should have sufficed to make such a thing impossible, much more the two united. This impudent dictation by the few to the many might have been expected to rouse in the many a just anger, great enough to make them sink all party differences while jointly resisting it; and it might have been expected that Liberals and Conservatives alike, without any high stretch of intellect, would have seen that, deeper than any legislative question which divides them, is the question whether they shall allow the principle on which all our legislation is founded to be contemptuously broken through.
>
> Thirty years ago Prince Albert gave great offence by saying that representative government was on trial. We are now approaching a supreme moment when its trial threatens to end in lamentable failure. If this failure occurs—if the 584 allow themselves to be coerced by the 86—then the 584 will be traitors to free institutions.

To quote Herbert Spencer again, "The net result of the labor of legislative bodies is always below the intelligence of the least intelligent member." That, to use a colloquialism, is a "mouthful."

Spencer is rather hard to read but any one, particularly statesmen, will be well paid for the effort.

Book Reviews

Atlas of Traffic Maps. Prepared by the Traffic Consulting Staff, LaSalle Extension University, Chicago, assisted by Charles E. Wymond, official cartographer of the Central Freight Association. Cloth; 10x11¾ in. Published by the LaSalle University Press, 4,050 South Michigan Ave., Chicago, Ill. Price $4.50.

This atlas of traffic maps is one of a series of texts and reference books comprising a course of training in traffic management. The atlas contains maps covering routes, and rate and classification groupings of various transportation agencies. It is equally valuable either as an independent reference book for traffic executives or as a part of the course in traffic management where such a course is given.

Apprentice Education. Issued by the Federal Board of Vocational Education, Washington, D. C. Five hundred and twenty-one pages, 6x9 in. Published by the Government Printing Office, Washington, D. C. Price, 55c.

This is a survey of part-time education and other forms of extension training in their relation to apprenticeship in the United States. The book covers various methods pursued in the states of the Union and also classifications of work done by apprentices. Factory and store vocational work also is discussed.

Locomotive Frame Welding

By A. F. Dillon

A LOCOMOTIVE frame must withstand the shocks and strains to which it is constantly subject while in operation. Imagine the amount of strain put on a frame while a locomotive is moving a train of 100 loaded cars, and possibly on an irregular track. With the continuous vibration, twisting and hammering that frames get, it is a wonder they stand up as well as they do.

Failures in frame welds may be attributed to incompetent welders, improper expansion, failure to retain the required heat, poor welding rods, and the releasing of the spreading device too soon.

If it is necessary to remove cross braces, stiffeners or radius rods, it is cheaper to remove them than make a second weld. During my experience in welding I have been ordered to weld a frame through the spokes of a wheel, and the results were what you or I would expect —a failure. The making of an important weld through a knot-hole opening is a poor way to secure success.

Systematizing your frame jobs, means that every man must know what to do and when to do it. This means that the helper must have the oxygen, acetylene, welding rods, flatters, fullers and sledges on the job, and see that the outfits are in readiness at all times.

We weld frames of all description, ranging in size from 3x4 to 8x8 in. The condition existing in every frame weld is not the same. There may be frames of a 4x4 in. dimension that require more expansion than some other frame of the same dimension, due to the location of the break or its relation to some section of the locomotive where more strength is required at one point than at another. When a frame is hard to expand because of its location or, of being closely coupled at the point of fracture, it is very necessary that the expansion be increased a small amount to take care of the contraction, which takes place more rapidly when the spreading device is taken out.

Table I gives the amount frames to be welded are

Table I—Amount of Spread Frames Should Be Given for Welding

Frames	3x4	in. section, allow	$\frac{1}{4}$ in. spread
Frames	4x4	in. section, allow	5/16 in. spread
Frames	4x4½	in. section, allow	11/32 in. spread
Frames	4x5	in. section, allow	$\frac{3}{8}$ in. spread
Frames	5x6	in. section, allow	13/32 in. spread
Frames	6x8	in. section, allow	7/16 in. spread
Frames	6x9	in. section, allow	$\frac{1}{2}$ in. spread
Frames	8x8	in. section, allow	$\frac{1}{2}$ in. spread

spread. The figures are approximate and based on our experience.

The most convenient method of spreading a frame is by the use of a frame spreader. Our method is to cut a slot in the frame at the point of fracture, to enable the use of a wedge, then by alternating the sledging first on the wedge in the frame, then on the wedge in the spreader, it is not hard to get the required expansion. In cases where it may be hard to hold the expansion, the use of two spreaders will eliminate troubles.

The use of jacks is not so sure a way to hold the expansion, especially in cases where it is necessary to keep the jacks in the frame for several hours. Our experience has been that with the strain placed on the jacks, they will give a little during the time between the spreading and the welding.

From a paper presented at the October, 1923, meeting, Chicago Section, American Welding Society.

The next step in the preparation of the frame is to cut the two slides to a double V, after which it is chipped. A piece of $\frac{3}{8}$-in. spring steel is then tacked at the bottom of the frame to serve as a foundation to start the weld. One of the main items in frame welding is that of holding a welding heat during the entire welding operation. Neglecting this precaution has been the cause of many failures. The use of 1½-in. lagging, tightly wired to the frame, will hold more heat than any other method I know of. The heat generated by the welding torches, which are kept on the frame from the start to the finish, will not radiate through the frame for any great distance, and the immediate section around the weld will be kept to a welding heat until the weld is completed. The use of three or four welding torches, as the case may require, will heat up the frame quicker than any other method. When the proper heat is obtained the welder is ready to continue, instead of having to tear down a furnace as is generally the case.

Keeping the Frame Hot

Our usual plan of welding is to lay a heavy ripple-weld, up one side, across the front, up the other side, etc., always keeping the back center of the weld higher than the front, continuing this method until the frame is completed.

In cases where the frame is larger than a 4x4 in., a piece of lagging is placed over the added metal and on the bottom of the weld, thus keeping the bottom of the weld practically as hot as the top. After the weld is completed it is trimmed on both sides, and, with the use of flatters, fullers and a sledge, the frame can be dressed up to almost any shape necessary. The spring steel can be easily removed from the bottom and, after the bottom is trimmed up, the lagging is again applied and the frame allowed to cool slowly.

In releasing the frame spreader there are many things to consider. In cases where it is hard to get the expansion, the logical thing to do is to hold the spreader until the trimming is completed. Where the expansion is fairly easy to get, the spreader can be taken out when the weld is three-fourths finished. Following this principle, we generally get a frame to come back to the original tram marks. In case a frame comes $\frac{1}{32}$ to $\frac{1}{16}$ in. long, it is an advantage, as you have a compression instead of a tension weld.

Our system is to take all the time necessary in making a weld, and follow the idea of letting the metal settle in as quiet a condition as possible. If the added metal is allowed to run all over the weld you are apt to get laps, checks and seams which, in most cases, are hard to get out.

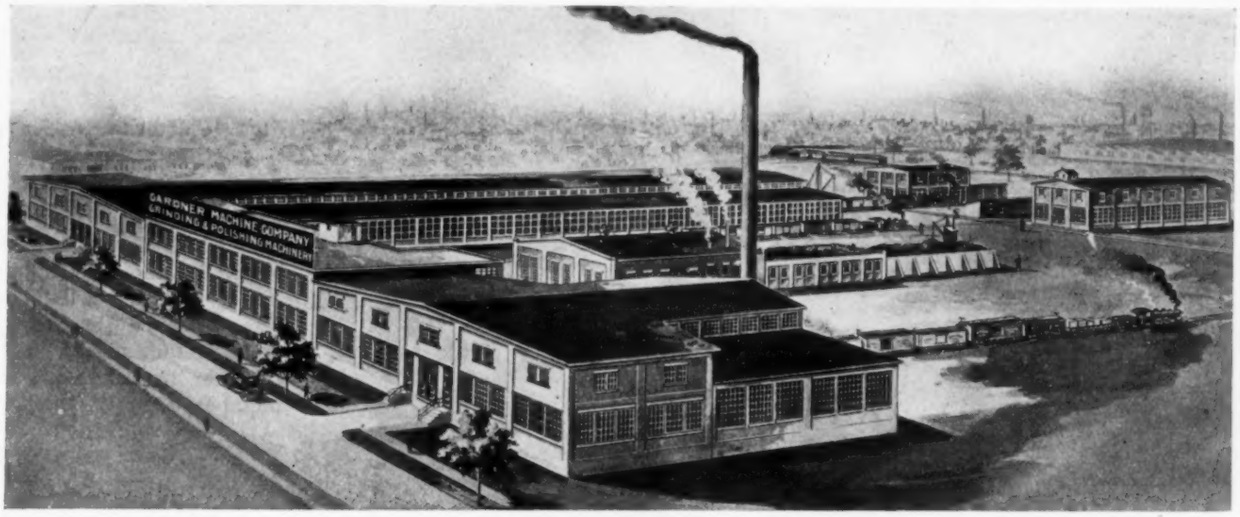
We use from 3 to 4 welders on all frames, the larger

Table II—Itemized Cost of Welding Locomotive Frames

Size of Frame	Labor	Gas	Oxygen	Rods	Total
6x4 in.	$11.72	$7.35	$4.20	$5.00	$28.27
4x5 in.	13.18	8.92	5.00	5.00	32.10
5x6 in.	14.70	14.70	8.40	5.25	43.05
4x8 in.	26.18	21.00	12.00	6.00	65.18
4x9 in.	26.18	15.75	9.00	5.75	56.68

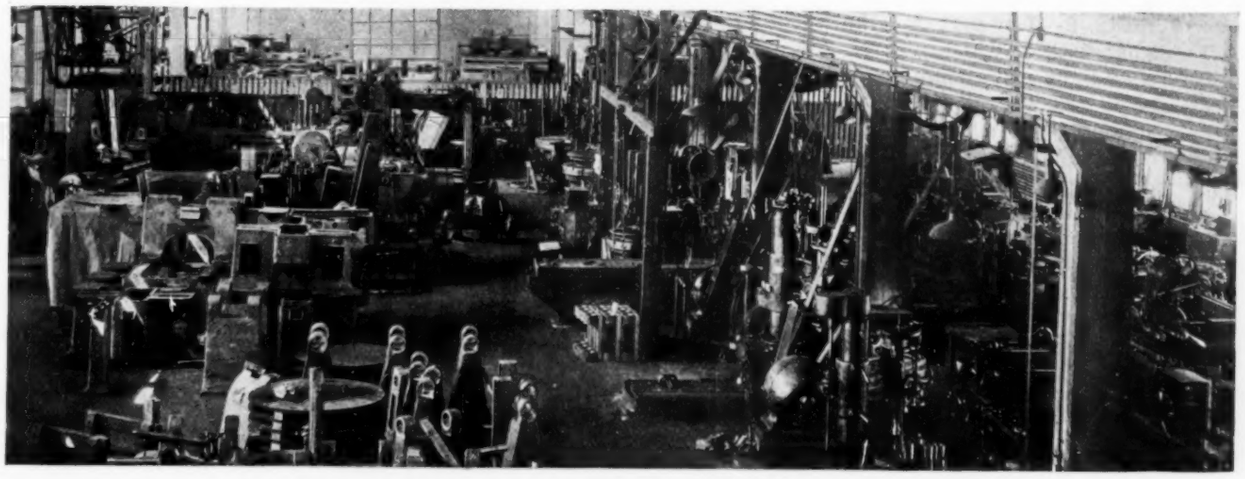
frames require 4 men. In this way no one gets to a point where he becomes so tired out toward the finish of the weld, that he starts piling in the metal rapidly to get the job completed. The welders are alternated at regular intervals, and they are not left on the job too long.

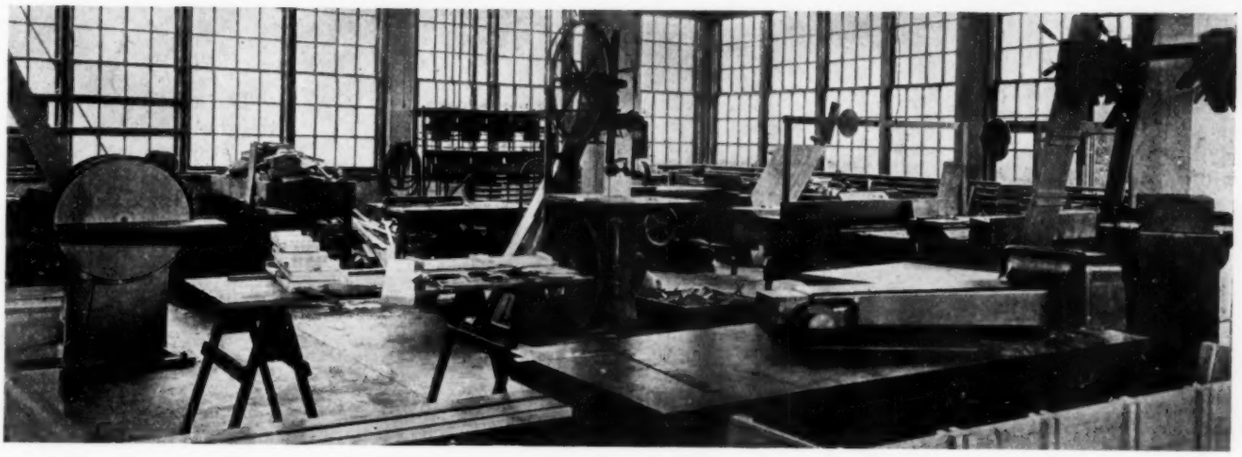
The costs of welds are given in Table II.



Where Machine Tools Are Made

Gardner Machine Company
Beloit, Wisconsin
Founded 1905





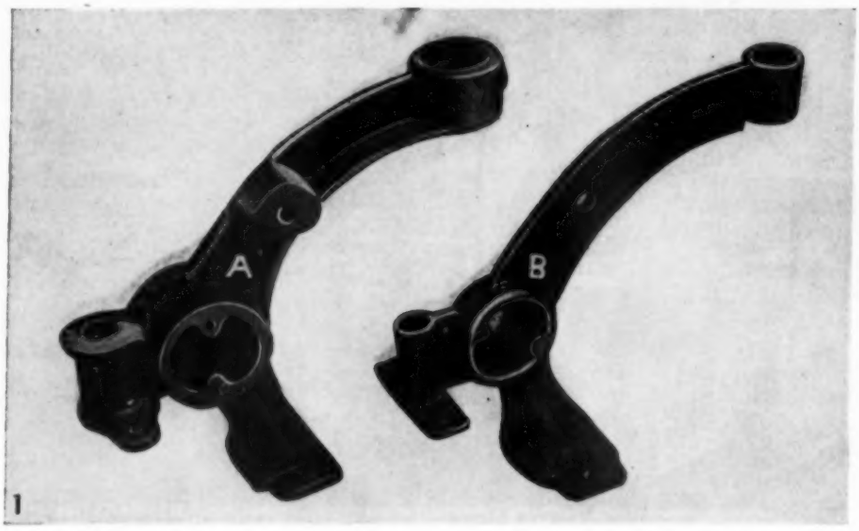


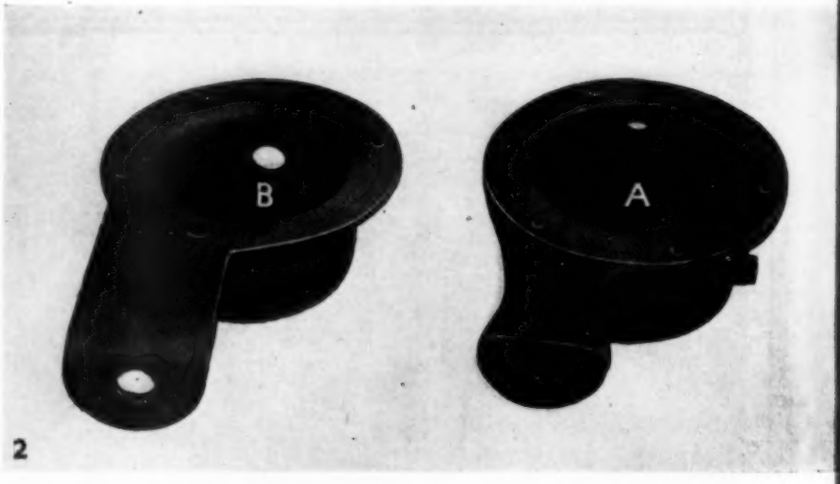
Fig. 1—Bracket for supporting vertical and horizontal shafts

The casting *A* weighs a little over 9 lb. and was replaced by the steel stamping *B* weighing 4 lb., 4 oz. The stamped bracket is made of four pieces, joined together by brazing. The metal is 0.187 in. thick.

Pressed Metal Parts Replace Castings

Photographs by courtesy Worcester Pressed Steel Company Worcester, Mass.

Fig. 2—The part *A* is an iron casting, which was replaced by a stamping of brass, shown at *B*. The stamping is made in five operations, including the piercing. While the casting weighs considerably more than the stamping, reduction of weight was not the object. Brass was chosen because of physical properties not possessed by iron or steel.



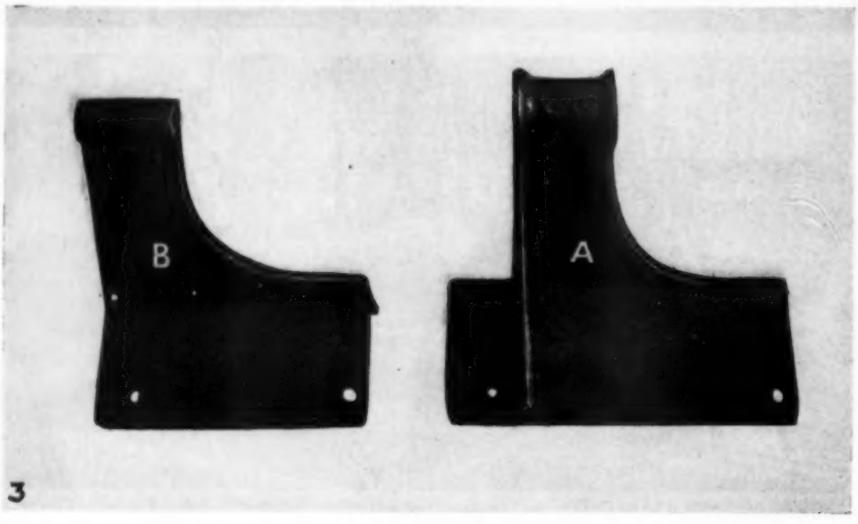


Fig. 3—Bracket

The casting shown at *A* weighs almost 9 lb., while the stamping *B*, which replaced it, weighs 8 lb., 4 oz. The stamping is made in four operations and the sheets forming the central stem are joined by spot welding. The bracket measures 8½x7¼ in., and is made of metal 0.87 in. thick.

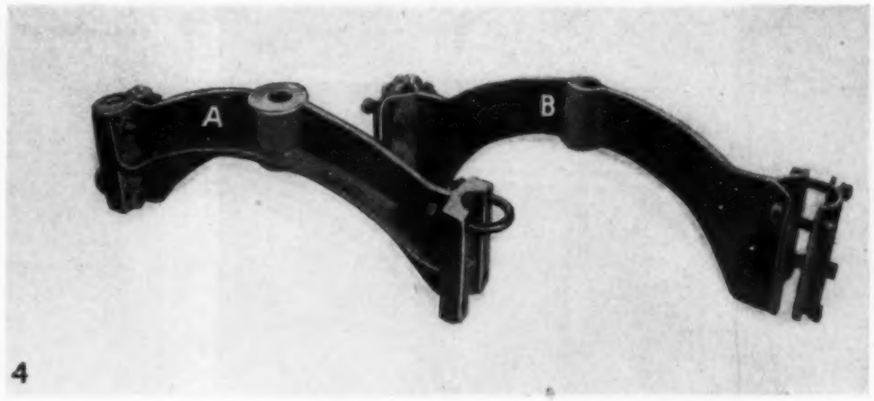


Fig. 4—Suspension bracket

The weight of the casting *A* is 11 lb., 5 oz. It was replaced by the stamping *B*, which weighs 8 lb. The stamping is of steel 0.187 in. thick. It is made in four parts, including the caps and requires two press operations on each part including piercing the holes. The arch is in two pieces joined by spot welding. Bracket is 16x6¾ inches.

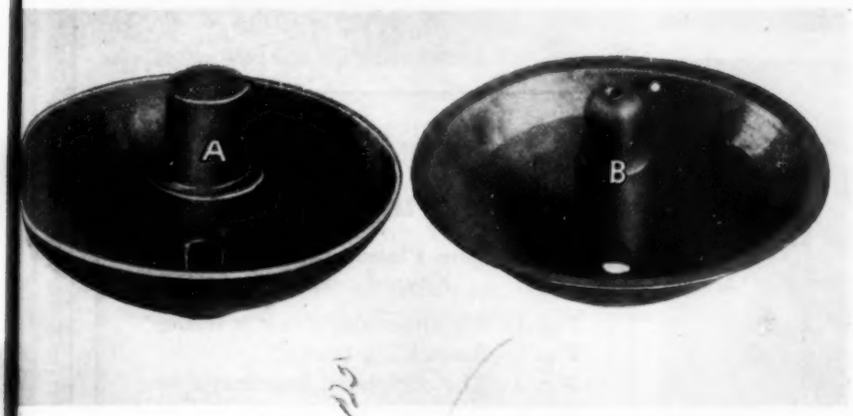


Fig. 5—Drip pan for a special machine

This part, as shown at *A*, was formerly made of cast iron and weighed 4 lb., 10 oz. It was replaced by the stamping of cold-drawing steel shown at *B*. The stamping weighs a little less than 2 lb., and is made of two parts forced together. The pan is made from metal 0.062 in. thick, and requires three operations. Three operations are required on the stem.

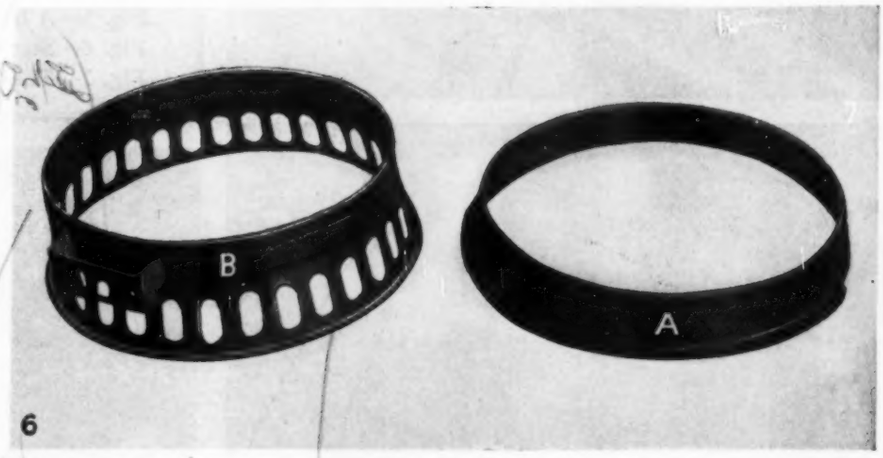
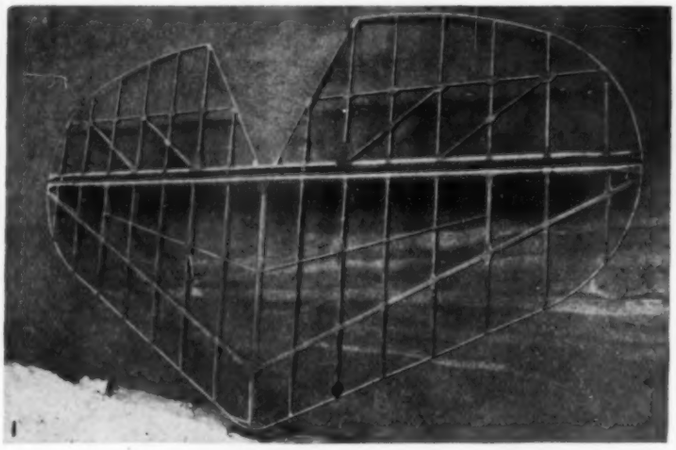


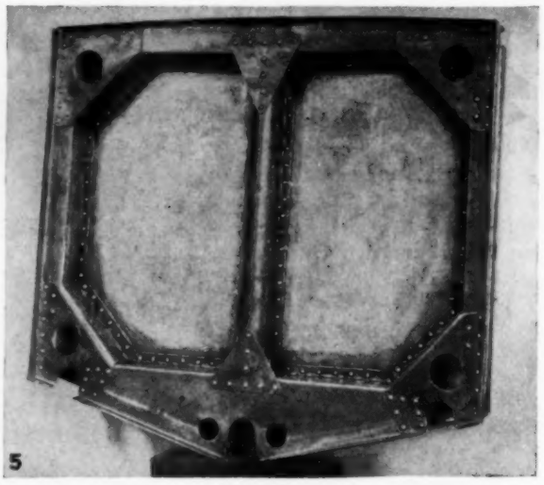
Fig. 6—Fan guard for humidifier

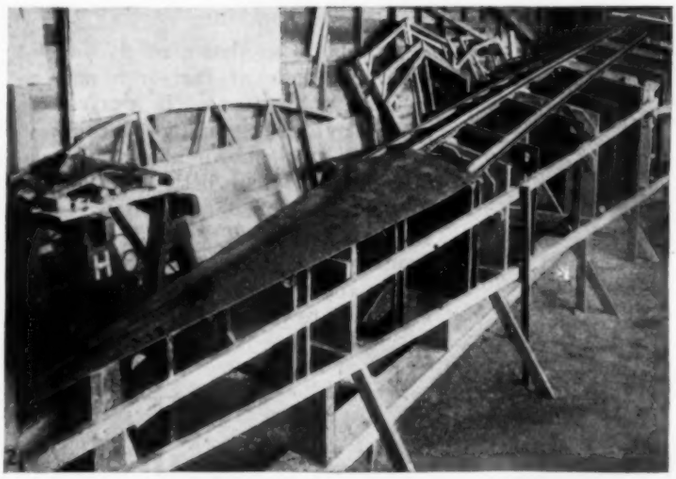
The casting *A*, weighing 6 lb., 10 oz. was replaced by the steel stamping *B*. the weight of which is 4 lb., 4 oz. The stamping is made of 0.078-in. steel, in two parts, and joined together by spot welding. Eight press operations are required.

Fig. 7—Top of gasoline pump

The casting *A*, weighing 19 lb. 8 oz., was formerly used for the top of a gasoline distributing pump. Now the stamping *B* is used instead. The stamping is in two parts and welded together. The metal used is 0.078 in. thick, and the weight of the complete top is only 5 lb., 7 oz., or 28 per cent of the cast top.



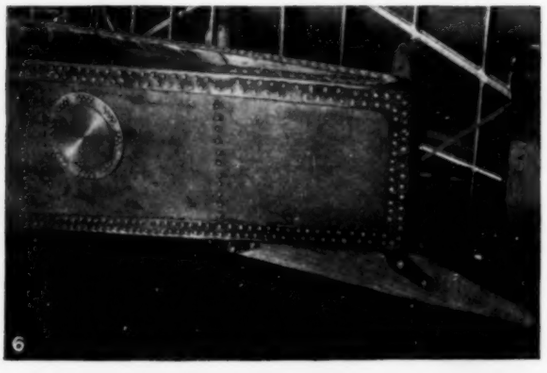


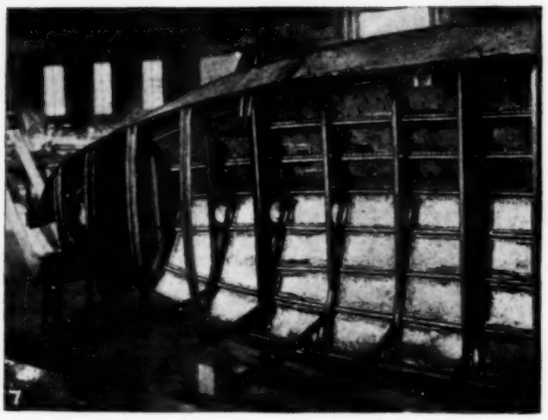


How Flying Boats of Metal Are Put Together

Aeromarine Plane and Motor Co.
Keyport, N. J.

Fig. 1—Stabilizer and elevator frame
Fig. 2—Assembling the tail
Fig. 3—The completed boat body
Fig. 4—Riveting the hull
Fig. 5—A bulkhead frame
Fig. 6—Stern post and skid
Fig. 7—The inside of the hull





Charts for Tension in Bolts and Torsion in Shafts

By R. Patterson

THE two simple alignment charts here shown are presented with the hope that they may prove as useful to others as I have found them. I have never seen any curves published on these subjects in this simple manner, so the charts may have some value in providing quick solutions for the problems in stresses for which they are intended.

Chart 1 gives the relation between the load in tension and the fiber stress of different sizes of bolts having U.S.S. threads. This chart was constructed from an old empirical formula found in many textbooks:

$$D = 1.27\sqrt{\frac{P}{S_t}} + 0.088$$

It saves the time of looking up a table containing areas of bolts at the roots of the threads and it also gives at a glance a comparison of loads and stresses for any standard bolt within the limits shown.

Chart 2 is intended for use when calculating the torsional stress in shafts. The load is shown in kilowatts, as it is assumed that the shafts are used in electrical installations. This chart was constructed from the following formula:

$$S = \frac{54{,}000 \times KW}{N \times R^3}$$

The derivation is as follows:

S = Stress in lb. per sq.in.
T = Twisting moment = $P \times R$
HP = Horsepower
P = Tangential force in pounds
R = Radius of shaft in inches
N = r.p.m.
J = Polar moment of inertia = $\frac{\pi D^4}{32}$
D = Diameter
KW = Kilowatts

$$HP = \frac{2\pi \times T \times N}{12 \times 33{,}000} = 0.00001587 \times T \times N$$

$$T = \frac{HP \times 12 \times 33{,}000}{2\pi \times N} = 63{,}025.2 \times \frac{HP}{N}$$

But, $HP = \frac{KW}{0.746}$

$$T = \frac{63{,}025.2}{0.746} \times \frac{KW}{N} = 84{,}484.1 \times \frac{KW}{N}$$

Now, the twisting moment is equal to the resisting moment.

$$T = 84{,}484.1 \times \frac{KW}{N} = PR = \frac{SJ}{R}$$

$$\frac{SJ}{R} = 84{,}484.1 \times \frac{KW}{N}$$

$$S = \frac{R\left(84{,}484.1 \times \frac{KW}{N}\right)}{J}$$

$$S = \frac{32R\left(84{,}484.1 \times \frac{KW}{N}\right)}{\pi \times 16R^4}$$

$$S = \frac{54{,}000 \times KW}{N \times R^3}$$

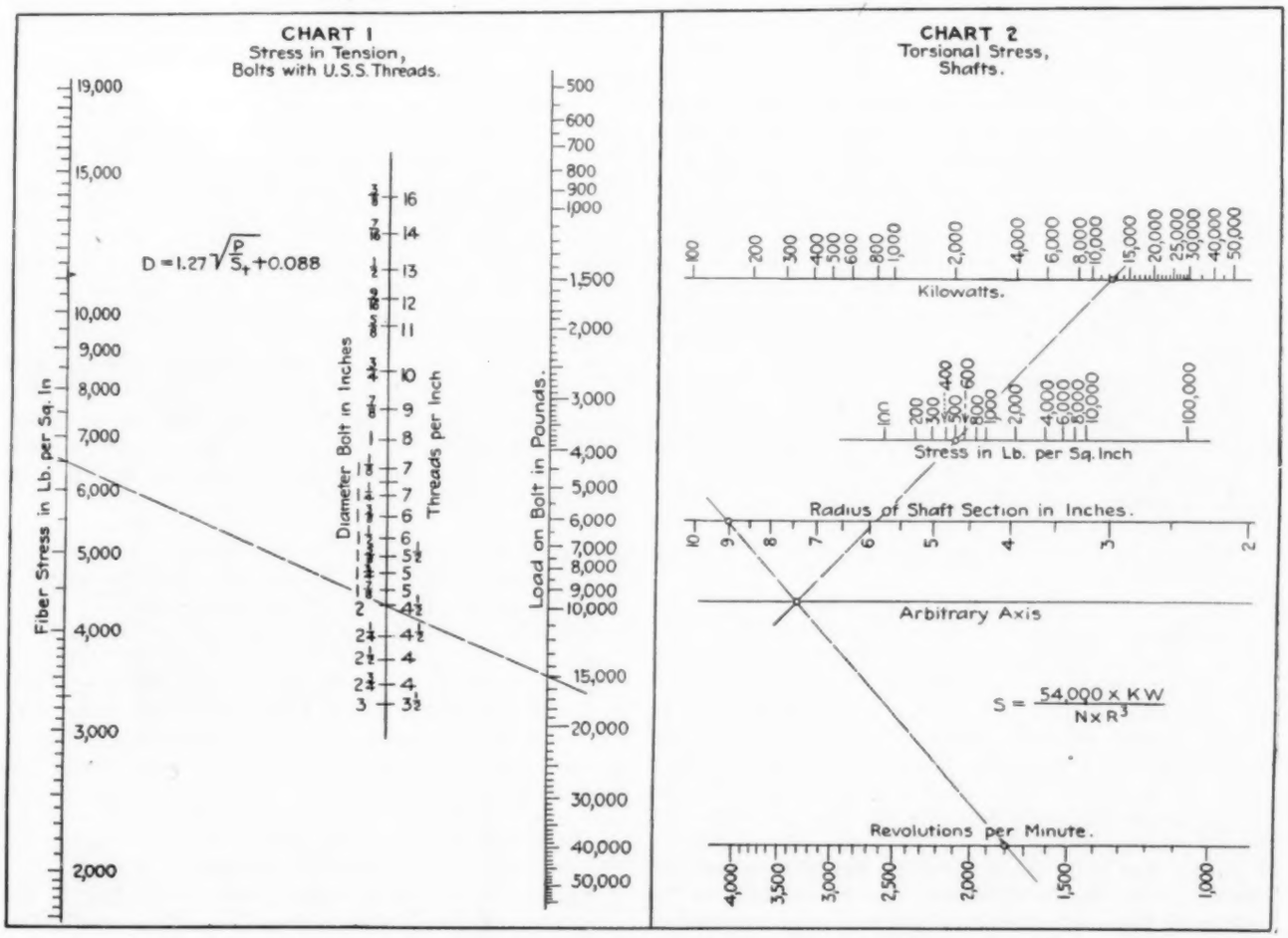


Chart 1—Alignment chart for tension in bolts. Chart 2—Chart for torsion in shafts

The axis showing the kilowatt rating on Chart 2 could be easily arranged to use a horsepower rating as well, by spacing off the horsepower to correspond to its equivalent kilowatt.

Grinding in Railroad Shops—Discussion

By George T. Huxford
General Superintendent, Diamond Machine Co.

In an article under the above title, published on page 60 of the current volume of *American Machinist*, Charles F. Henry offers some criticisms in respect to the speeds and feeds cited by Howard Campbell in his article "Grinding in the Railroad Shops," appearing upon page 861, Vol. 59, of the same journal. In one of his paragraphs Mr. Henry refers to a job upon a Diamond grinding machine, illustrated by Fig. 8 of Mr. Campbell's article.

In our opinion and we have made many experiments upon all classes of work, the figures submitted by Mr. Campbell indicate fairly good practice. The peripheral speed of the wheel is approximately 3,150 ft. per min. against the 3,200 to 3,500 ft. that we advocate for this class of material and the rate of traverse should be increased only to about 22 ft. per min., instead of the 30, 40 or 50 recommended by Mr. Henry, to obtain most satisfactory results.

Strange as it may seem, the factors involved in face grinding, upon the Diamond and similar machines, do not parallel those to be regarded in the application of vertical-spindle machines of the P. & W. or Blanchard type. This difference is difficult to explain, but that it exists is amply attested by our long continued experiments with both types.

It should be remembered that increased rate of table traverse is equivalent in some respects to increased feed, and it is easily possible to pass the wheel over the work faster than the cutting particles of abrasive can remove the material, even though the depth of cut is slight. Such practice will cause the wheel to glaze by reason of excessive pressure and the work will be overheated by the friction as quickly and as surely as by the dragging of a wheel that is loaded because of too great depth of cut.

Depth of Cut Not Excessive

We do not consider that the depth of cut cited by Mr. Campbell, 0.008 in., is excessive for a piece of no greater width than this, and we believe that it could be materially increased with safety. In general it may be considered that the amount of feed (depth of cut) should be reduced in proportion to increased area of work in contact with the wheel.

Nor can we concur in Mr. Henry's belief that there is insufficient amount of finish left on the casting. One of the great advantages to be derived from face grinding as an alternative to planing or milling, is that patterns may be lightened and an appreciable saving in metal thereby effected. When the skin of a casting is to be removed by means of a steel cutting-tool there must be sufficient finish allowance to permit the tool to get under the scale immediately, else the edge will soon be broken down by the hard material. Hardness, however, has little effect upon the grinding wheel and therefore the finish allowance may be reduced to the minimum required to produce the necessary smoothness and flatness of surface.

We agree with Mr. Henry that it would be an improvement to raise the work toward the center of the wheel, and thus reduce the area of contact. However, the area of contact in the case cited is well within the limits that are satisfactorily covered by face grinding machines of this size, and there is much to be said in favor of clamping the work directly to the table.

We would be very glad to have Mr. Henry or any other interested party visit our shops in Providence, where he could see the variety of work handled upon our machines under widely differing conditions.

Teach Your Boy a Trade—Discussion

By William Reid

Certainly! teach your boy a trade; and, if he is mechanically inclined, teach him the *machinist's* trade. But first find out if your boy *is* mechanically inclined. Some boys—and their parents and friends—*think* they are so inclined when the inclination turns out to be only temporary. Pick the permanently inclined boy, and teach him the machinist's trade.

What trade has greater inducement for the right kind of boy? If he desires wealth he stands a good chance of obtaining it. One of the wealthiest men now in the country started in as a machinist. Thousands of men of only lesser wealth did the same thing. The printing-press, the steam engine, the type-casting machine, the automobile, the airplane: all were invented and perfected by machinists. It is true that but few monuments are erected to machinists; but what greater or more lasting monuments could be conceived than the good done to humanity through the achievements of some of our eminent mechanics.

Thousands of the large manufacturing plants of today had their beginnings in kitchen, basement or barn, where their founders pegged away early and late to get a start, finally attaining the goal of success and erecting the vast establishments that are now monuments in their memory. The writer has known many splendid men who, he believes, would have made their mark in the world as creators of things mechanical, if only their parents had allowed them to get started on the right road.

Machinists will be paid better wages as time goes on, and their service will be in constant demand. Besides, money is far from being the final consideration to the man who loves his work. In the old bicycle-boom days, there were unskilled workers running drill presses and similar machines who made from five to ten dollars a day, while toolmakers in the same factories received but three or four dollars; yet no toolmaker would exchange places with the pieceworker for the sake of the temporary advantage of the higher pay.

The pieceworker is the "human cam" of which W. J. Fisher, Jr., speaks on page 174 Vol. 60, of the *American Machinist*, while the toolmaker always has a pleasant and interesting job before him. I pity the poor clerk in bank or department store, not only because he is poorly paid but because his work is monotonous and uninteresting. I learned the machinist's trade myself and, like Mr. Fisher above quoted, I have never wasted any time in wishing I had studied to be a "doctor," a "barber," or "a dirt farmer"—or even a politician.

One trouble with the machinist's trade lies in the fact that the machinists seldom boost their profession. They should take a lesson from the printers.

Industrial Cost Accounting for Executives

By Paul M. Atkins

Article twenty-nine—Cost accounting service to production control—Auditing the work of the planning department—Supplying cost reports—Comparative cost data for the foreman

IN ONE of the early articles of this series emphasis was laid on the service of the production control system of a factory to the work of the cost department. It is now time to consider briefly the aid which a satisfactorily designed and operated system of cost records may bring to the control of production. This assistance will vary, depending on the kind of business and the methods of control employed, but certain general cases may be presented to guide the factory executive who wishes to obtain all possible benefits from the measurement of what goes on under his direction in terms of dollars and cents and to the cost accountant who desires to supply the needed information in the most usable form.

FACTORY manager, production manager, production engineer, plant engineer, foremen and the assistants of all of these may all obtain information of one kind or another from the cost department which will help them in the better control of the tasks under their direction.

It is an excellent idea for the cost department to assume the task of auditing or checking the papers which they receive from the planning department, not with the purpose of trying to "get something on the planning department," but in the spirit of endeavoring to aid in the better management of the business.

Another method of rendering service to the planning department is by supplying it with reports that will serve to reduce the facts in its records to a common unit and subsequently guide it in its plans.

One of the ways in which the cost department can be of service to the planning department is in a fashion which is often overlooked and which all too frequently is simply a point of irritation and discord between the two departments. All business men are, or should be, familiar with the work of firms of auditors who audit at periodic intervals the financial books of companies and certify as to their correctness. One of the phases of such work which has been receiving increasing consideration in recent years is the help which the auditors can give a company by pointing out recurring troubles and suggesting remedies for them. This same idea can well be taken over into the relationship between the cost department and the planning department. A brief consideration of this point may prove suggestive and helpful.

A large part of the material which is handled by the planning department comes to the cost department and the service of the former department to the latter in this connection has been noted. It is a common and unavoidable condition which is frequently found that the work of the planning department is carried on under relatively high pressure, especially insofar as the dispatching of the work through the factory is concerned. It is not strange, therefore, to find that mistakes are made sometimes and are allowed to slip by uncorrected. It must not be inferred from this that the planning department should be excused from the task of checking its own work to assure its correctness, but it does present an opportunity for excellent and helpful service on the part of the cost department.

All too often the condition above described results in mutual ill-feeling between the two departments with the natural consequence that the control of the work is slackened and unneeded expense incurred. It is an excellent idea for the cost department to assume the task of auditing or checking the papers which they receive from the planning department, not with the idea of trying to "get something on the planning department," but in the spirit of endeavoring to aid in the better management of the business. The sooner mistakes are caught the easier it is to correct them, hence any error or apparent error which is found by the cost department should be investigated and corrected at once before it can affect the welfare of the business.

There is ample opportunity for this kind of thing when the variety and number of papers which come from the planning department to the cost department are considered. Stores and worked material issues and credits and worked material in slips offer the opportunity for slips to be made in entering order numbers and quantities. Such errors can be caught when they are filed, or in any case when they come to be totaled, for incorrect order numbers will bring the wrong kind of materials to the order and incorrect quantities will be noticeable when the quantity on the order is considered. Mistakes of such nature cannot be allowed to go uncorrected if reasonably accurate unit costs are to be obtained. Another error which happens all too frequently is the loss of one of these slips. That, too, can be caught when the slips are totaled for any order, since it is obvious that a product cannot be made without any material or with a quantity really sufficient for only a small part of the scheduled output. If the issue can-

For the author's forthcoming book. All rights reserved.

not be found a duplicate can often be made, for if the exact quantity issued cannot be ascertained, the required quantity may be used in its place. Of course, the latter figure will probably not be absolutely correct, but it will be approximately so and hence will be better than no correction whatever. It will result in comparatively accurate unit costs being calculated and the inventory affected can be adjusted whenever it is checked.

The time tickets also require constant watching. Usually the amount of the labor charge will be figured correctly because the payroll must be prepared and prepared on time, and hence the time recorded thereon must be correct or made so at that time. It does not result in consequence that the order number is accurate and that other details are as they should be, and so they should be checked by the cost department as the tickets follow the established routine. It should always be remembered that in most cases the allocation of the earned burden to the product depends on the time tickets, and as a result a wrong order number means the incorrect charging of two items and not simply of one. Mistakes in regard to time tickets, therefore, give double errors.

The possibility of catching errors depends very largely on the training and experience which the cost department clerks have received. If they are to perform their auditing functions properly it is essential that they should not only be familiar with their own routine tasks but also with the general operation of the factory. Part of the requisite training can be given personally by the head of the cost department in the form of short, informal talks, and by personal instruction. Part of it can be gained by supervised trips through the factory from time to time, and part can only be obtained by the interested effort of the clerks themselves. Much of it is the result of their keeping their eyes and ears open and taking an intelligent interest in the work which passes through their hands. This is simply one of the many reasons for selecting high grade clerks for the work of the cost department. A ledger clerk in the accounting department, who posts standardized entries which he can feel practically certain are correct into a ledger, has a far simpler task than the cost clerk who not only must perform routine tasks but also should have a certain amount of critical judgment of the work which passes through his hands.

An Analysis of Errors

It was mentioned above that one of the tasks which is now being assumed by auditors is to point out the causes of mistakes and to suggest means of preventing them in the future. The same kind of task may well be assumed by the cost department bearing in mind that their suggestions are simply in the nature of advice which the planning department is free to accept or leave as it chooses. Of course, it should be possible for the cost department to carry the matter to the proper executive and have its suggestions embodied in the form of an order, but if it becomes necessary to do this the spirit of co-operation which ought to exist between the two departments is likely to be so seriously damaged that the greatest benefits which might be attained are almost certain to be lost.

This subject has been discussed so extensively because it is felt that sufficient emphasis has not been given heretofore to its importance. The cost and planning departments in many respects are mutually supplementary and the antagonism which too often exists between them is greatly to be deplored. The possibility of the work described above being carried out in a satisfactory fashion depends very largely on the spirit of co-operation and mutual forbearance which ought to exist between the heads of the two departments, a spirit which is greatly promoted if they and the functions which they control are subordinated to one person directly whose prime interest lies in the factory.

Cost Reports for the Planning Department

The second way in which the cost department can render service to the planning department is by supplying it with reports which will serve to guide it in making its plans. The planning department keeps records of various kinds in terms of physical units such as pounds and number of pieces, but very often much of the significance of the reports is not appreciated until they are translated into dollars and cents. It is quite essential, also, if comparisons are to be made to reduce the facts to be compared to some common unit. It is impossible, for example, to say whether the loss of hours of labor or fifty pounds of material is greater unless we know the value of each. It is quite possible for a factory to be mechanically efficient and still be unprofitable. How is the factory manager to decide whether or not to install automatic conveying machinery unless he has some idea of the relative cost of the transportation of the product by machinery and by hand. In time consumed in transportation and speed of delivery the argument may be wholly on the side of the power operated conveying device, but on the other hand it may be used so little that the cost of transportation both as a total and as a cost per unit of product may be materially increased over the hand method previously employed. Many other cases of the same sort are likely to arise and in almost all of them the factory manager must turn to the cost department for an answer if he expects one which will be more than a guess.

The general manager is vitally interested in the general efficiency of the operation of his business, but he has not the time to study the details of the production methods and control to locate the small inefficiencies which, when multiplied many times, mean losses. He delegates the authority and the responsibility for such matters to the factory manager and the latter's subordinates. They are the ones who should be even more interested in the reports concerning the operation of the factory than the general manager. They should be supplied with copies of the reports prepared for the general manager insofar as their own work is concerned and special reports should be prepared for them when asked for. If the cost accountant and the managers of the manufacturing group are awake to the possibilities of securing information from this source, many opportunities will be found where it could be used to advantage.

Cost Data for the Foreman

It is a mistake also to stop with the factory and production managers and not to proceed further down. The foremen of the operating departments are often the ones who most need to be informed of the dollars and cents results of their work. Frequently they have no interest in cost records until it has been stimulated by practical demonstrations, and then they often become the most eager users of the reports which are prepared for their benefit. It is essential that they be instructed both in the reading of the reports and graphs and in

the significance to them of all the figures represented.

A few illustrations of the different kinds of reports which often prove to be of aid in the operation of the factory may serve to make clearer the benefit which the operating departments may derive from the work of the cost department. The foreman, for example, should be informed of the value of the supplies which are being consumed in his department. Such a report should be prepared with care and in a comparative form. It does not mean much to a foreman to be told that the supplies have cost a certain sum for the past month unless he has some basis for knowing whether that represents a satisfactory or unsatisfactory showing. His interest can only be stimulated by showing him how far he is missing the goal at which he is trying to aim.

Ways of Presenting Comparative Statistics

There are several ways in which comparative statistics may be presented to him, and as they are illustrative of other reports it is worth while, perhaps to examine them somewhat in detail. In the first place the expenditure for supplies for a current period may be compared with the monthly schedule of expense for materials of such kind. This is the figure which ought not to be exceeded unless there is a large amount of overtime work. It may so happen, however, that business is so slack and the amount of the expense for supplies scheduled for normal conditions is too large to be a proper measure of the expense for the period.

Under such conditions there are two possible comparisons which may be made to advantage. The first of these is one which appears quite material—the comparison of the cost of supplies for the current period with those of the preceding month. The best way to do this is by means of a graph which permits showing the figures for the entire year to date. Another basis of comparison is to show the value of the goods produced in the foreman's department and the ratio of the cost of supplies to this value. This ratio forms a very interesting basis of comparison for it enables a comparison to be made between periods of varying activity and also a somewhat different measurement of like conditions as indicated by the amount of the output.

The use of supplies is pretty much under the control of the foreman or his immediate assistants. No one else is in a position to contest this expenditure in a really adequate and intelligent fashion. If the foreman is of the right kind and has the interest of his department at heart, reports of the kind indicated above are almost certain not only to arouse his interest but to provide him with the information which he needs to control the use of supplies.

Other reports of a similar nature can well be prepared also for the departmental expense over which the foreman himself has control. Care should be taken not to include those which the efforts of the department head cannot affect in any substantial degree for often they make up a considerable amount of the expense charged, and properly charged, against the department. The fixed charges are the outstanding example of this kind of expense, but there are others which fall in substantially the same class—liability, insurance premiums which depend on the departmental payroll and that, in turn, in a large measure on the volume of work being done by the company are an illustration of the group in mind.

There are other accounts, however, which serve as records of work which is very much under the control of the foreman and reports on these are important to him. The reclamation of errors account is one of the records which should be presented to him in detail. It is not always possible for the head of the department to prevent all mistakes from happening, but a careful study of the costs of those which are made aids greatly in putting him in a position where he can stop them in large measure. Sometimes the fault lies in a condition, sometimes in a person, but in any event, the foreman can act on a basis of definite knowledge and not from mere guess work. It not infrequently happens that persons other than the foreman are interested in the results of the report of the cost of making errors good. The manufacturing standards department often finds the basis for some of its work in the record of conditions which are proving unsatisfactory, and using the material so revealed as a starting point it is enabled to carry on investigations which result in permanent improvements being made. A report of the kind under discussion is, or should be the means of deciding whether the matter is of sufficient importance to warrant extended efforts to correct it or not.

The retainer accounts were discussed in the preceding article as furnishing the substance of one of the reports of interest to the general manager. The same report is of vital importance to the planning department for it is the department which is responsible for keeping the employees in the factory occupied in a gainful manner. In a way a report of these accounts is one way of measuring the efficiency of their work in planning, scheduling and dispatching.

Two factory departments are interested in reports of another set of accounts. The plant engineer and the maintenance department are concerned with the problem of making the necessary repairs at the least cost. Hence a comparative statement of the various maintenance accounts provides them with information which may aid in guiding the work which they do. The foreman also is interested, for the rapidity with which breakdowns take place depends very largely on the kind of use which is given the equipment by the workers under his control. Large repair and maintenance costs are an almost certain indication of the need of greater attention on the part of the foreman and his assistants to the way in which the machinery is manipulated.

Control Data

It is now time to consider certain other reports which do not form a part of the cost accounting routine but which may be prepared by the cost department and which are of benefit to the factory. It is common practice among the better organized companies for the planning department to maintain a record of the idle machine time and the reasons therefor. This record is of unquestionable help in the operation of the factory, especially insofar as the planning, scheduling and dispatching of the work is concerned. It is of additional importance, however, to translate the record of hours into one of dollars or cents. If the factory manager and his immediate assistants know how much the idle machine time is actually costing them, they are then in a position to decide intelligently what is to be done about it. Without the knowledge of the amount of the loss they cannot know whether it is cheaper to accept it or to incur further expenditure in order to reduce it. It is only from such a report as this that it is possible, for example, to obtain some idea of the cost of unbalanced equipment or production. From the record of the

idle time and the burden rates it is a simple task to prepare a report showing all the facts in as much detail as may be desired.

It would be possible to give still other illustrations of the benefits to be derived by the various manufacturing departments of a company from the work of the cost department. Factory manager, production manager, production engineer, plant engineer, foreman, and the assistants of all of these may all obtain information of one kind or another which will help them in the better control of the tasks under their direction. It ought to be realized more and more that the cost, the accounts and the records are not a mere appendix to the financial accounts but a very important risk in the control mechanism of a manufacturing business, serving in a large measure the factory and those in authority over it.

Tanks for Airplanes Fabricated from Sheet Aluminum by Welding

By D. C. McGiehan

IT IS, of course, desirable that airplane parts be as light as possible, although it is necessary that they embody strength. Strength in three directions (longitudinal, vertical and transversal), however, is by no means adequate, for an airplane when aloft is subject to a series of combined stresses, due to action and reaction between itself and the air. A part of a plane that comes in for at least its due amount of strain is the tank. Stresses are introduced into it by the vibration and working of the frame to which it is attached, by comparatively rapid changes in atmospheric pressure and temperature, and probably most important of all, by the slopping around of its liquid contents due to the variable positions of the plane.

Therefore, it is necessary to design and build airplane, gas, oil, and water circulation and expansion tanks to meet conditions that are entirely different from those to which an ordinary tank is subjected. They must be capable of carrying their contents in any position but must not permit them to change too rapidly, for this not only tends to badly strain a tank but is also apt to materially affect the equilibrium or proper control of the plane. To overcome these conditions the tank is equipped with baffle plates. These are virtually partitions that divide the inside of the tank into a number of compartments connected with each other by means of openings in the partitions. This design affords not only a reinforced tank but one in which the mobility of contents is greatly reduced.

Tanks embodying this principle of design are built by an aluminum welding company for the United States Government. The Government specifies the shape and outside dimensions and an aeronautical engineer employed by the company works out the details.

This company usually follows a definite procedure in the fabrication of the tanks. The sheet aluminum varying in thickness from No. 22 to No. 16 gage, depending on size and use of tank, is first cut to size and then passed through rolls whereby ribs are rolled into the metal at specified locations, usually those where baffle plates are to be attached. The purpose of these ribs is two-fold; first to stiffen the tank and second to provide for expansion and contraction that would otherwise distort the tank. After ribbing the material for the body of the tank it is bent longitudinally to the desired shape and the edges of the longitudinal seam are flanged and welded. Bending is done over wooden straightedges by the use of wooden mallets. Following the forming of the body, holes for the connections are cut and the connections welded in place.

Next the baffle plates are cut and formed. This forming consists in flanging around the opening and edges and usually ribbing vertically through the center and around the edges. The ribs serve to stiffen the plates, as do also the flanges around the openings, while the edge flange permits pinning the baffles to the body of the tank. Next the baffle plates are put in place and holes drilled through their flanges and the body of the tank. The pins are then slipped through from the underside and slightly swaged to hold them in place. This method of securing the baffles has to be resorted to, since it is impossible to weld on the inside of these tanks because insufficient space and the obstruction caused by the baffles themselves prevent manipulation of a blowpipe. Straight riveted construction is not used, for such would prove especially inadequate in aeroplane tank fabrication because of the practical impossibility of obtaining a lasting leakproof riveted joint. The operator applies flux to the ends of the pins projecting from the tank and then directs the blowpipe flame vertically on each, in turn, melting it down and fusing it with the metal surrounding the hole, thus making an absolutely tight joint. Finally the tank ends are flanged and welded into place. The tanks are then checked for length by inserting them between two angles bolted to a steel plate forming the table top.

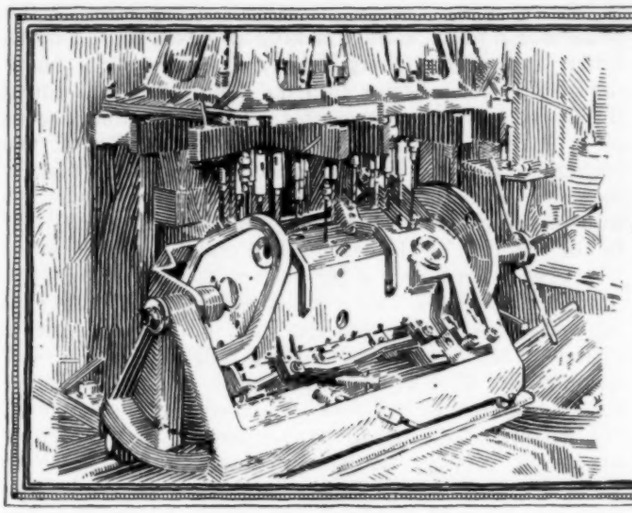
Correcting Errors in Length

In checking lengths an occasional tank is found slightly too long or too short, caused by a variation in the width of the flanges. In the former case the flanged edges are trimmed and in the latter the edges are built up. Building up is an operation in which the blowpipe is used to great advantage. To do this the tank is stood on end, a special sheet aluminum flux is painted on the welding rod, and lips located a few inches apart are built up to the required height around the edges to be lengthened. These lips establish a sort of grade line and aid the operator in increasing the flanged edges to the same width throughout the periphery of the tank.

This completes the tank with the exception of testing, which consists in immersing each tank for one hour in a 10 per cent solution of sulphuric acid, to remove any traces of flux that may be obscuring pinholes. When taken from the acid solution the tanks are immersed for another hour in clean water to remove the acid and are then scrubbed. Next, all openings but one are plugged and each tank is held under water and subjected to a certain air pressure, depending upon its shape and thickness of metal.

Although all tanks are thoroughly tested by the Government after reception not one has ever been rejected. Further, "crash-proof" tanks have been built by covering these standard tanks with 2 in. or more of live rubber and in one instance a "crash-proof" tank was filled and dropped from an altitude of 4,000 ft. It collapsed but the oxy-acetylene welded seams held and none of its contents was lost.

Abstracted from an article in Vol. 3, No. 1, Journal of the American Welding Society.



Tool Engineering

By

Albert A. Dowd
and
Frank W. Curtis

Some points on pattern work for the tool designer—The use of cores and loose pieces—Importance of fillets—Three-part flasks

IN JIG and fixture work, bosses and lugs are used frequently; and as they project from the body of the fixture they cannot be made a part of the pattern, unless they lie in such a position that they can be withdrawn easily from the sand with the pattern. If they project in other directions they must either be made in the form of loose pieces which can readily be detached from the pattern, or else a core box must be used.

In Fig. 581 are shown several examples of patterns having loose pieces. In the example *A* a corner of a jig pattern is shown in the mould at *K* and a boss *L* projects from one side. This boss could not be removed from the sand if it were fixed to the pattern. Therefore it is made in the form of a loose piece and held in place by the two wires shown. In molding work of this kind the usual method is employed and the sand is rammed around the various parts of the pattern; but before removing the pattern itself from the sand, the molder pulls out the wires which hold the loose piece in place and then "picks in" the loose piece and removes it as shown at *L* in the view *B*. In order to do this, the width of the loose piece must not be more than the width at *M*.

When a boss is thicker than the width of the wall of the jig, it can sometimes be made as shown in the example *C*. Here the loose piece is made in two parts *N* and *O*, which are picked in to the space *P* one at a time and thus removed from the mold. This is not commonly done, except when very cheap patterns are made, as it is considerable trouble to get these two pieces out of the mold without disturbing the sand.

In the example at *D* a simple form of jig pattern is shown in the mold and several loose pieces are at the top of the pattern, so that they will be formed in the cope side of the flask. It is not absolutely necessary to make the pattern in this way, as the process mentioned and illustrated in Fig. 579 can be used if the pattern is made solid. In other words, the molder can cope down by doing a little extra work. The molder's work is easier, however, if a pattern is made with loose pieces.

In the pattern shown at *E*, the portions *F* and *G* are held in place on the pattern by means of wires, which act as dowels and which are removed from the patterns when the molder is ramming up the drag. After the work has been turned over, the loose pieces are placed in position before the cope is put on, and are then treated in the manner mentioned and illustrated in examples *A*, *B* and *C*. The tool engineer is obliged to understand these matters only sufficiently so that the patterns required for his jigs will not necessitate expensive work or difficult molding.

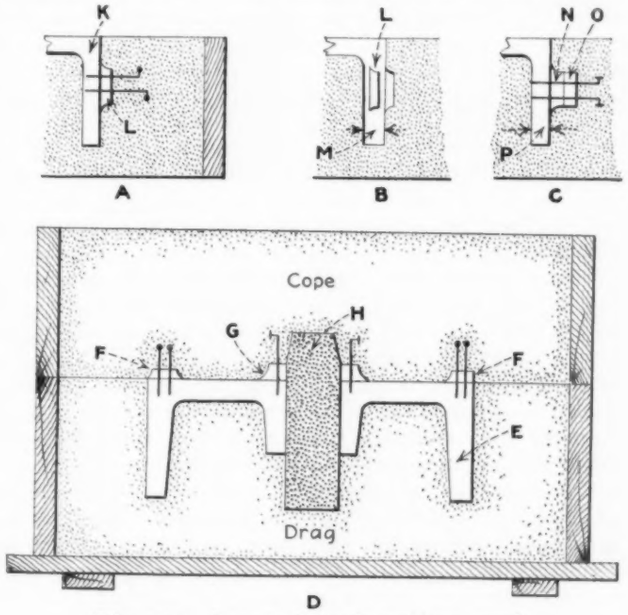


Fig. 581—Loose pieces in pattern work

In order to realize more fully the application of cores to various kinds of work, we believe the examples shown in Fig. 582 will be of interest. In the diagram shown at *A* the work *B* is a flanged cylinder casting, having a long hole in it which does not extend entirely through. Now, if such a casting be molded with a core, a support can be obtained at only one end of the core. Therefore, if the core were made only about as long as shown at *C*, it would very likely become dis-

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placed when molding. It should be made much longer, as at *D*, in order that it may have sufficient support to keep it in position. One of the most common forms similar to this is the automobile piston, in which a very large and heavy core must be set so that it will be properly supported and retain its position during the

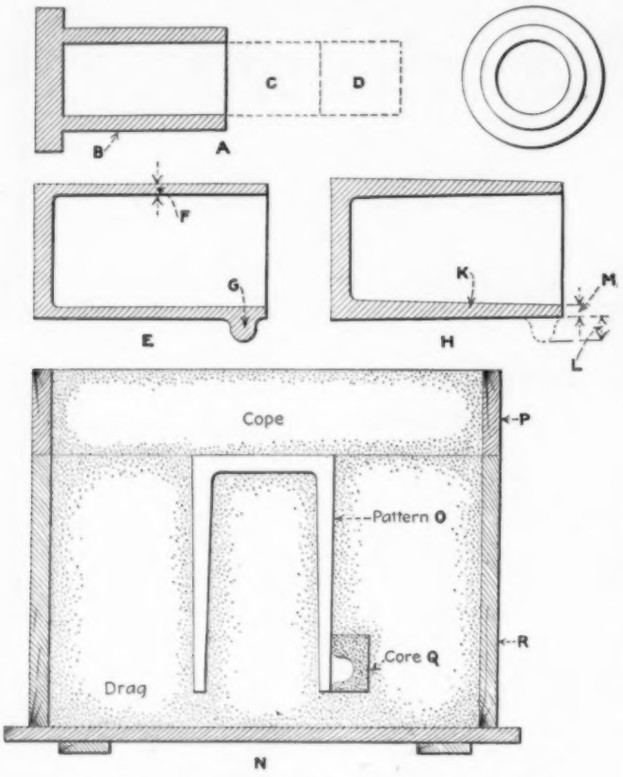


Fig. 582—Examples of simple core box work

molding process. When proper provision is not made for this, imperfect castings are the result.

In the example at *E* a rather common form of casting is shown. The walls *F* are somewhat thin, and yet at one side there is a boss *G* which is considerably thicker than the wall of the casting. Now, there are two ways in which a casting like this can be molded; it can be made from a two-part pattern with a long core for the internal portion, or it can be molded vertically, using only a small core for the lug *G*. In the latter case, the pattern would be made like that shown at *H* and sufficient draft would be provided on the outside and inside of the pattern to permit easy removal from the sand. The wall *M* not being thick enough to allow the boss *L* to be picked into it, would be made perfectly plain and no boss or print would appear on the outside of the pattern.

A separate core like that shown at *Q* in the example *N* would be set up against the pattern *O* by the molder when ramming up the drag side of the pattern. This core would remain in the flask *R* after the pattern itself had been removed and after the cope side *P* had been finished. When the metal is poured into the mold, it will follow the outline left by the pattern and will also run into the core *Q* and form the lug required. Cores of this kind can often be made to assist in the solution of molding problems.

It is a mistake to make up jig and fixture patterns too cheaply, and one of the common forms of neglect on these cheap patterns is the use of very small fillets in the corners. The result of this cheapening of the pattern is a poor casting, lacking in strength and durability, and while it may answer the purpose in many cases, it is much better to make use of generous fillets in jig work wherever possible. In the example shown at *A* in Fig. 583, there is practically no fillet at the corner *D*, while in the example *B* a generous fillet *C* makes a much better and more durable casting. So also in the example *E* the large fillets at *F* and *G* add to the strength of the casting and make molding easier.

A simple corner of a jig pattern is shown at *H*, the two parts *K* and *L* being glued and nailed together as shown. If a heavy wooden, wax, or leather fillet is placed at *M*, a very good casting will be obtained, but a small wax fillet at this point never gives as good results as the larger one does. So also in the example *N*, the pattern itself would have a corner at *P* which is practically sharp, and here it might be advisable to form the wood to a radius as shown at *O*. A leather fillet can be used for the same purpose, but they are more or less expensive and not always kept in stock for the large sizes.

Large Fillets and Plenty of Draft Required

The example shown at *Q* is a pattern for a simple jig body having four legs *R* and pads *S* acting as supports on the opposite side. There is also a central boss *U*, projecting above the surface at *T* and having a core print *V* set in it. This example is given in order to illustrate the use of large fillets and plenty of draft on the pattern when making up jigs or fixtures. In reality, the outside of the legs *W* would usually be slightly tapered in order to allow the pattern to be removed from the sand more readily. The tool engi-

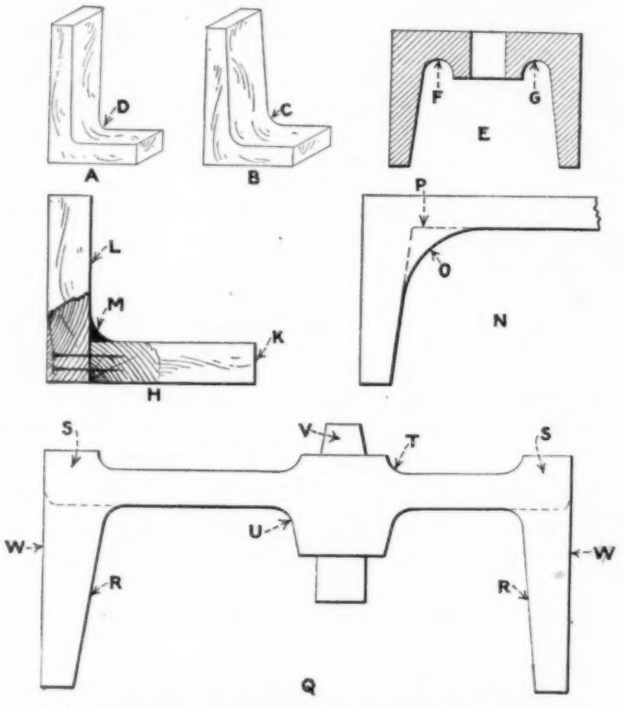


Fig. 583—Importance of fillets in pattern work

neer should bear these points in mind when designing, in order to facilitate the work of both pattern maker and molder.

In some kinds of pattern work, where work has two overhanging flanges and intermediate ribs, a three-part

flask is necessary in molding, particularly when the pattern is quite long. An example of this sort is shown in Fig. 584 at *A*. A pattern of this kind is made as shown in the example *B* with a core print at each end. The pattern can be separated along the line *C-D* in order to make the molding easier. It can be seen that a pattern of this sort could not be easily rammed up in the mold if it were made in one solid piece and molded in the usual manner. Even if it were possible to pack the sand in all around the ribs and under the flanges, it would still be impracticable to remove the pattern from the sand without injuring the mold.

By making the pattern as shown at *B* the process of molding is similar to those which have been previously described, but nearly all of the pattern is in the center flask *G*, which is called the "cheek." The flanges of the pattern being removable, the mold is made, as shown at *E*, with one of the flanges removed in order that the molder can pack the sand in around the ribs; after this has been done, the flange is put on and the cheek mold completed. The cope and drag flasks *F* and *H* are later placed in position and rammed up in the usual manner. Then the cope and drag are removed and the flange pattern drawn out from each side of the cheek.

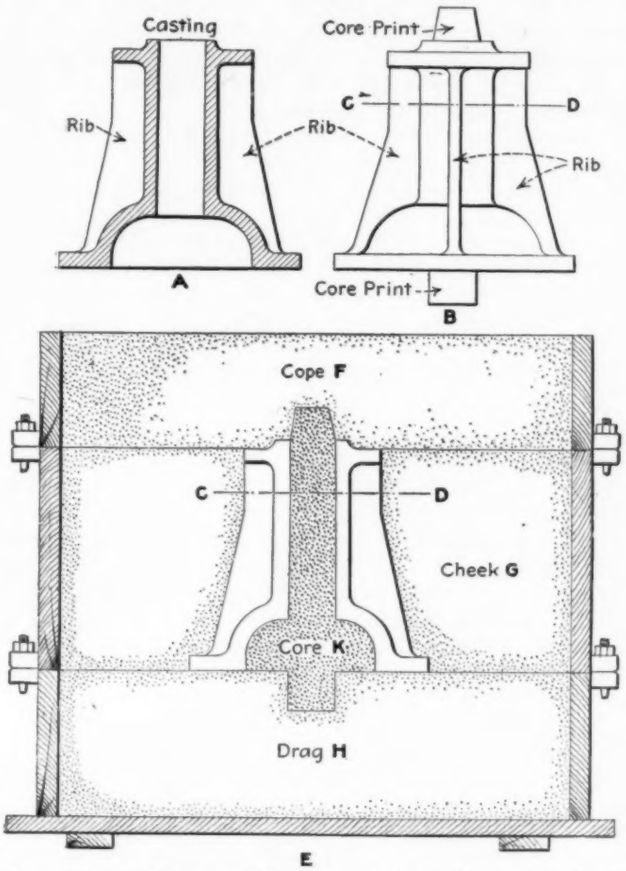


Fig. 584—Molding problems requiring a three-part flask

There are many other forms and varieties of molding operations, but the majority of them do not affect the tool engineer and his work to any great extent, so that we do not believe it necessary to mention these matters here. It is, however, advisable to speak of the shrinkage of metals, and the necessity for making patterns slightly larger than the casting in order to allow for this shrinkage.

Various metals have different amounts of shrinkage and therefore "shrink rules" of various kinds are used, according to the nature of the metal from which the casting is to be made. The tool engineer is frequently called upon to check up the accuracy of patterns, and he must therefore be provided with shrink rules of the proper kind when this work is to be done. It is sometimes necessary to estimate the weight of a casting from the pattern, and this weight can be approximated by weighing the pattern itself and using a factor to determine the weight of the casting, according to the material from which the pattern is made and also the material used for the casting. A simple pine pattern without cores usually weighs about ⅛ of a cast-iron casting made from it. Other materials vary considerably, and rules for the proportions can usually be obtained from the patternmaker.

We believe that sufficient information on the subject of patterns has been given here to enable the tool engineer to proportion his jigs and fixtures in accordance with normal foundry practice, but it is always advisable for the progressive man to visit the pattern shop from time to time and note practical examples of pattern making. In this way, he will become more and more familiar with the requirements and necessities of this class of work.

Safe-Guarding Overhead Valves

From time to time our attention has been called to accidents that have occurred in connection with the operation of overhead valves. In many cases ladders are used to enable workmen to get into a position where they can reach such valves to open or close them. Unless the men who do this work are careful to use ladders of the right kind, and to see that the ladders are set so that they will not slip or fall over, serious consequences are not at all unlikely. To reduce the number of such accidents, we have strongly recommended the installation of permanent stairways or ladders and elevated platforms, installed so that they will afford secure and ample space in which to work. This precaution has been effective in reducing the number of accidents from this cause, but employers are often reluctant about following the suggestion because of the expense involved, especially when a large number of overhead valves have to be considered.

The idea of affording proper protection for the men can be carried out in other ways, in case the expense of providing permanent stairways, ladders, or platforms is considered to be prohibitive. Sometimes it is quite possible to extend the spindle of a valve sufficiently to bring the control-wheel where it can be easily handled from a safely accessible place already existing. When this is not the case, a beveled gear may be bolted to the valve wheel or keyed directly to the spindle, a beveled pinion in mesh with the main gear being keyed to a vertical shaft running down to the floor, so that the valve can be operated without the necessity of climbing up to it. Instead of a pair of beveled gears, a gear and worm may be used if preferred. A still less expensive way to make it possible to operate the valve with safety consists in providing it with a sprocket wheel carrying a chain that hangs down far enough to be easily reached from the floor.

These methods for controlling the valve from the

From the *Travelers Standard*.

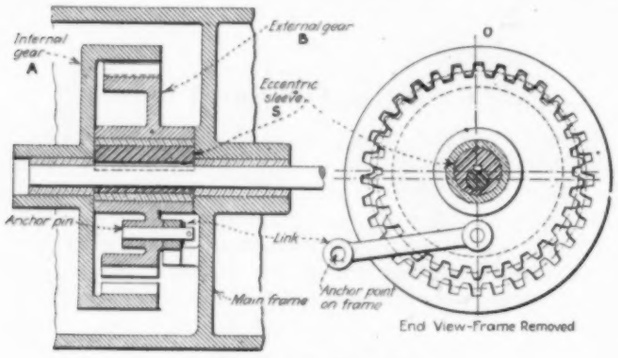
floor are of no use in connection with the packing or repairing of valves, but they do away with the danger of the men falling when operating overhead valves, and they also have the advantage that in the event of a valve breaking while it is being opened or closed (for example, in consequence of water-hammer action) the workman is far less likely to be injured.

Annular Gearing, Its Design and Application—Discussion

By B. L. Madden

The excellent article on "Annular Gearing, Its Design and Application" by P. H. Bryant on page 125, Vol. 60, of the *American Machinist*, is so comprehensive that it may seem presumptuous on my part to attempt to further clarify this interesting subject. However, it is sometimes difficult for one not entirely familiar with this form of gear train to quickly visualize the manner in which it operates, and I have found the following explanation to be easily grasped.

Referring to the accompanying illustration, which is Fig. 2 from Mr. Bryant's article, the 30-tooth external



Annular gear train

gear B is fastened to the framework of the machine in some way that will prevent it from rotating but will allow of other motion. It is seen that the movement of the external gear is one of translation—not rotation—in a circle, the diameter of which is 2 divided by the diametral pitch, or twice the eccentricity of the sleeve. When the external gear has moved once around its path it has traveled a distance of $\frac{2}{\text{diam. pitch}} \times \pi$ or twice the circular pitch, and has dragged the internal gear through the same distance.

The internal gear A has 32 teeth and the speed of a point on the pitch line of this gear will be

$$\pi \times \frac{32}{\text{diam. pitch}} \times \text{r.p.m.}$$

and from the above, we already know that the speed of a point on the external gear is

$$\pi \times \frac{2}{\text{diam. pitch}} \times \text{R.P.M.}$$

Since there is no slippage between the internal and external gears, a point on the pitch line of the internal gear must move at a linear speed equal to the speed of translation of the external gear. We are, therefore, able to equate the two expressions and it is then found that

$$\frac{\text{R.P.M.}}{\text{r.p.m.}} = 16.$$

Motor Shop Problems

Four Wheel Brakes and Flywheels

By Frank C. Hudson

IF THERE is such a thing as a saturation point in the automobile industry, nobody in Detroit seems ever to have heard of it. The automobile shops are girding up their loins, which I presume means tightening your belt or hitching up your suspenders if you still wear 'em, and getting ready to beat the 1923 output. This doesn't mean that all shops are running 100 per cent of maximum production—but it does mean that they are ahead of this time last year and all of them planning for some increase, while some few are actually proposing a tremendous increase.

The shop men would be happier if they could start production with few changes from last year. For any change means new tools, new fixtures, new gages and new grief until the new things get the kinks ironed out of them and everything is running smoothly. But the sales department wants new things to talk about, even though the dear public breaks its neck to buy whatever is left over from last year.

Mechanical or Hydraulic Brakes?

The four-wheel brake has caused a stampede in many quarters, that extends clear down to the Star. Then too there is the clash of ideas between the mechanical and the hydraulic brake, with the advocates of each type ready to prove that the other is a snare and a delusion, even if it isn't a positive menace. But everyone whether four-wheel braked or not, is condemning the action of a dealer in a two-wheel braked car for displaying in his window a wrecked car of a rival with four-wheel brakes, claiming them to be the cause of the accident. And this not a thousand miles from the city of Brotherly Love.

Either kind of brake adds work and trouble for the shop man as well as for the service station, especially until it comes into much more common use.

Machining Practice on Flywheels Varies

Motor flywheels are fairly well standardized in most cases but the methods of machining vary widely. Some makers of large quantities stick to the vertical boring mill, usually with a side head, and claim high production at low cost. Others cannot see any merit in vertical machines but pin their faith to horizontal lathes especially equipped. Still others are using station-type, vertical machines in large numbers or newer developments along this line. According to our efficiency friends, at least two of these methods must be wrong, but you can't make those who use them believe it.

Those who cut the teeth for starter gears directly in the fly wheels have, however, practically standardized on a semi-steel casting. Some use cast iron and shrink or screw on a steel ring gear for the starter. In any case there is remarkably little trouble from broken teeth.

Cutting the angles on the ends of the teeth, to allow the starter pinion to enter easily, is done in a variety of ways. Some use a hand milling machine, but one shop at least sets up a gear hobber so the hob trims the teeth to the desired angle on the entering side only and makes a continuous operation.

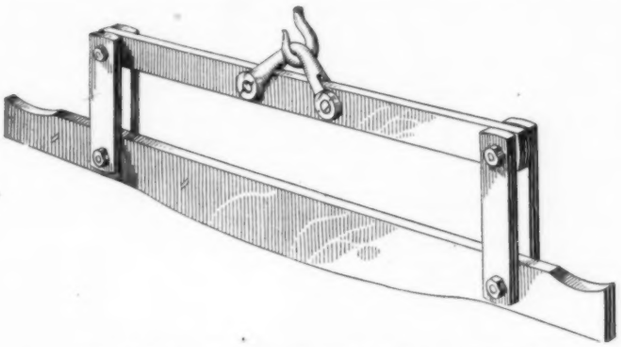
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Sling for Mounted Driving Wheels

BY HERBERT F. CRAWFORD

Here is a little different type of sling or crossbar than is usually used for handling locomotive driving wheels on their axles. As the illustration shows, the sling consists of a heavy flat bar with the ends hollowed out so as to receive the rims of the driving wheels between the spokes, and hold the wheels against the



Sling for handling driving wheels on axle

side slip. Near each end, the sling is suspended by links which in turn are fastened to an upper crossbar, this bar being suspended from the crane hook by substantial eyes. The claim for this type of sling is that it has less tendency to swing under load, and makes it easier for the operator to handle mounted wheels from the track to the wheel-turning lathe.

Air-Operated Compensating Mandrel for Holding Pistons

BY A. J. CAYOUETTE

The accompanying illustration shows a quick acting air-operated compensating mandrel for holding pistons while the turning operations are performed in one chucking. The mandrel was adapted to a No. 6 Warner & Swasey turret lathe and operated by a double acting air cylinder.

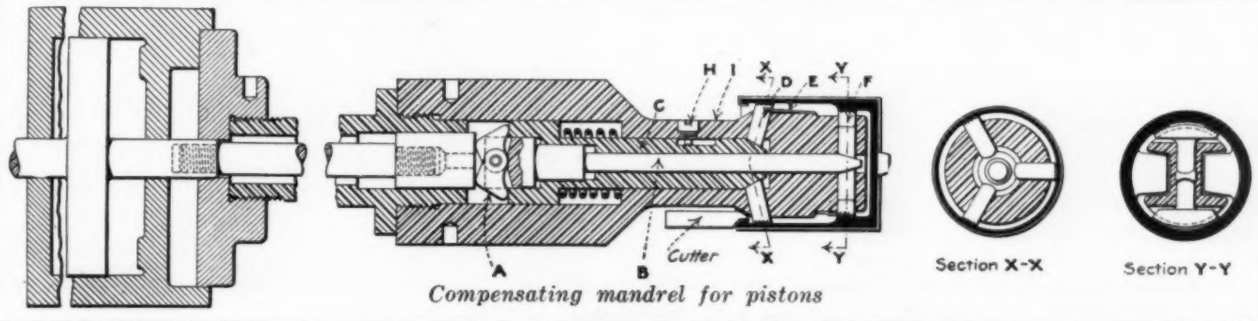
The piston shown on the Mandrel is turned, faced, centered, and the inside of the open end machined in one chucking. The piston is held firmly and accurately by two sets of jaws. One set grips at the top of the piston and the other set grips near the open end. Because of the variation in the castings at these locating points, it was necessary to have each set of jaws grip independently. This compensation was obtained by employing a pair of equalizing blocks *A* to distribute the pressure from the air cylinder to members *B* and *C*, which force the jaws outward thus gripping the piston. At section *X-X*, three round holes are machined to guide a set of hardened steel jaws *D*. The flat springs *E*, force the jaws to close when the pressure is released to remove the work. These springs also prevent the jaws from turning or falling out.

As shown in section *Y-Y* the end of the mandrel body is machined to clear the wristpin-hole lugs inside the piston. Hardened-steel jaws *F*, are also guided in round holes and have slots milled across the ends. These slots also prevent the jaws from turning. The flat springs *G* serve the same purpose as springs *E*.

Member *C* is made a sliding fit in the body, and is beveled at the small end to correspond with the angle of the jaws. A pilot screw *H*, prevents member *C* from turning. Member *B* is a sliding fit in member *C*, and in the body. It also is beveled at the small end to correspond with the angle of the jaws. The equalizing blocks *A* are guided in a slot in member *B* and float about a pin that is intended to keep the blocks in place. When the pressure is applied on the equalizing blocks, each block should have a contact point on the air plunger and on members *B* and *C*. A compression spring forces members *B* and *C* against the air-cylinder plunger.

The diameter of the mandrel was made smaller at *I* to permit the machining of the inside of the open end of the piston. The cutter, as shown for this operation, is held in the square turret on the cross-slide.

Although the mandrel just described is air operated, it may also be operated by the regular equipment.



Compensating mandrel for pistons

Multiple-Operation Press Tools

By Amos H. Hawley

The press tools shown in Fig. 1 were designed for the production of levers for paper perforators, and completed the work in one stroke of the press.

A completed lever is shown in Fig. 2, together with the operations necessary to produce it. Before the multiple tools were made, operation 1 was performed in a wire straightening and cutting-off machine, operation 2 in hand forming tools, while operations 3 and 4 were performed by dies in a press. Both the latter operations were completed in one stroke of the press.

The operation of the tools shown in Fig. 1 is as follows: The wire is fed by the operator through opening *A*, passing over the forming anvil *B* and under the swinging arms *C* and *D*, coming to rest against the adjustable stop *E*. At the beginning of the stroke the wire is cut to length. As the stroke continues, forming arms *C* and *D* are swung downward and inward by the links *F* and *G*, bending the wire in a U-shape over the anvil *B*, the arms coming to rest during the further stroke of the ram. At this point slide *H* is brought into action and bends the two ends of the wire as shown in the third operation, Fig. 2, after which slides *I* are brought into action by cam *J*, forming the bent ends as shown in the fourth operation in Fig. 2. The work is now complete as far as forming is concerned. At the completion of the return stroke, an ejector composed of parts *K*, *L* and *M*, knocks the finished piece off the anvil, after which it drops through the bottom of the die and into a box. The only work required of the operator was to feed the wire and trip the press.

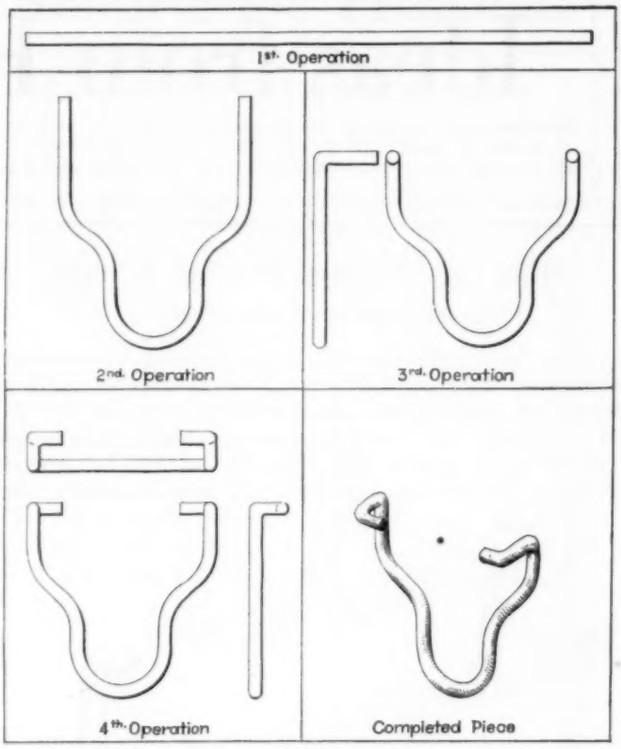


Fig. 2—The work in different stages

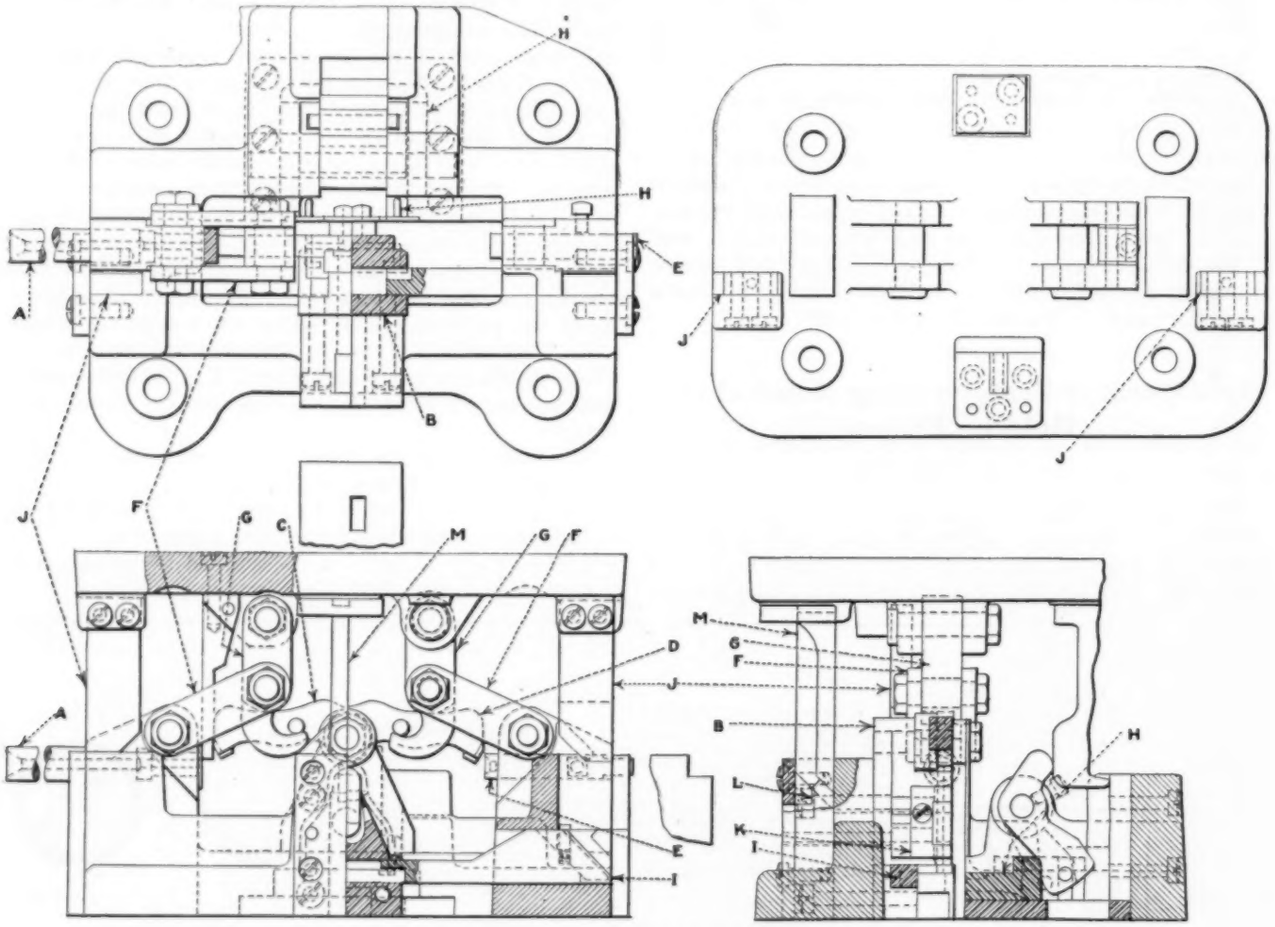


Fig. 1—Press tools for making a bent-wire lever

Double Tool for Planing T-Slots

By William Clancy

Planing the undercut portions of T-slots by means of two "hooked" tools, one right and one left hand, is a job familiar to every all-round mechanic and one that requires a considerable degree of skill in the art of measurement if the finished slot is to be symmetrical. The illustration shows a tool that cuts both ways from the center at once and relieves the operator from guesswork as to which side of the slot is going to be the deeper.

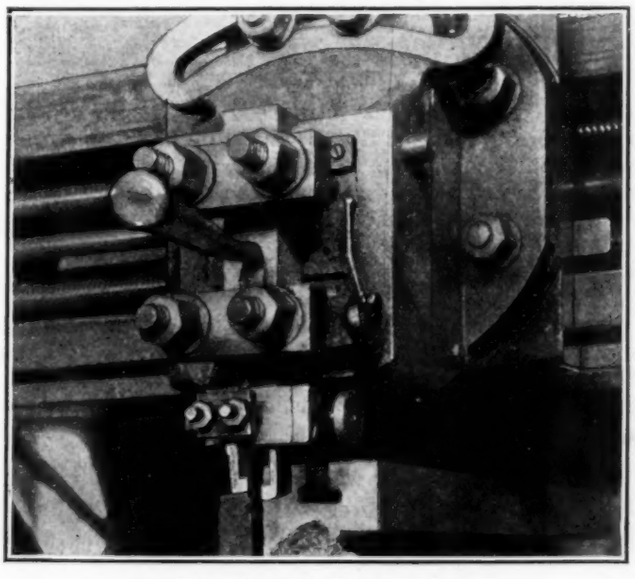
There is a square shank of substantial size to be clamped in the toolholder of the planer and at its lower end are two slides so gibbed to the shank and to each other as to form a very rigid unit, capable of extension or contraction in a horizontal plane. A right-and-left screw, turned by means of the small knurled head, or wheel, to be seen at the right of the tool, moves these slides in opposite directions simultaneously and at a uniform rate.

The cutting tools are forged from 1x½-in. tool-steel bar and cut off to leave a short shank. They are held in their respective slides by small stud bolts and a strap in the same manner that a larger tool is held in the clamps of the clapper, and are thus capable of independent adjustment when setting up.

A straight-sided slot is first cut in the work to the full depth and width of the central portion, using a single square-nosed tool in the usual manner. The special holder is then put in place and, with the slides as close together as they can be set, the cutting tools are adjusted to drag over the bottom and each against its respective side of the slot already cut.

At each pass of the planer table the operator gives the little knurled wheel a twist in the right direction with his thumb and finger, which advances the tools by a definite amount in opposite directions. By counting the number of turns of the screw and observing the position of the zero mark the operator knows without measuring when the full width of the undercut has been reached; at which time the planer is stopped and the tools returned to central position ready for the next cut.

As in all undercutting tools, the clapper has to be lifted so that the tools will pass over outside the work when the planer table is in reverse movement. A cam to lift and hold the clapper was provided, but the operator found it more convenient and reliable to use a bar about two feet long, driven into a cross hole in the shank.



Double T-slotting tool

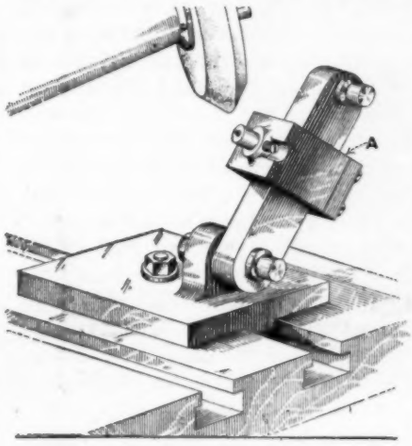
Device for Dressing Grinding Wheels to Determine Angles

By H. Mayer

London, England

The wheel dressing device shown herewith is designed to be used on the surface grinding machine for beveling the periphery of the wheel to definite angles with more than ordinary degree of accuracy.

The base is made from a piece of T-iron or a casting, machined on the bottom and one side and having a tenon to fit the slot in the grinding machine table. On the top, an upwardly projecting boss is drilled and reamed in a direction parallel with the locating tenon to take a clamping stud upon which a sine-bar is mounted. As this stud is also the lower button of the sine-bar, the reaming should be carefully done and the fit of the stud should be exact. The sine-bar can be made of mild steel. The holes for the buttons should be accurately located at a convenient distance apart; 5 in. being the dimension usually chosen. The upper button may be shouldered and forced into the hole in the bar; the lower button, as above mentioned, must have a longer shoulder to pass through the bar (in which it is to be a force fit) and extend through the boss on the base far enough to take a clamping nut.



Device for producing accurate angles on grinding wheels

The diamond holder is affixed to the slide *A*, which is so fitted to the bar as to slide up and down easily but without shake. The screws at the bottom of the slide provide means for keeping the latter in proper adjustment.

To set up for a given angle, multiply the sine of that angle by the distance between the centers of the buttons and set the sine-bar by means of slips or height-gage so that the vertical distance between the buttons is equal to the product. This setting can be made either on or off the machine.

After clamping the device on the table of the machine, bring the center of the sine-bar directly opposite to the centerline of the wheel spindle and move the diamond up to the wheel by means of the cross-feed. Dressing is accomplished by moving the diamond-holder slide up and down the bar by hand, feeding in as necessary with the cross-feed of the machine.

If the same angle is desired on the opposite corner of the wheel, it may be obtained by turning the device around on the table.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*
March 13, 1924

Tax Reform as Well as Tax Reduction

A RESEARCH report on income tax administration, just issued by the National Industrial Conference Board, is very much to the point. So much attention has been paid to the vitally interesting subject of tax reduction that the need for simplification of tax machinery and for elimination of many administrative abuses has been driven from the public mind.

It should not be forgotten that the present tax bill is double that of ten years ago and now takes one-eighth of the income of every man, woman and child in the country. Under such a burden as this the citizens of the United States are entitled to demand the utmost in economical administration of the income tax laws.

The Conference Board, as a result of the survey, recommends a Congressional investigation of the abuses listed in its report. The practice of officials of the Government leaving federal service to become "tax experts" is particularly condemned. While we are inclined to question the value of investigations by legislators we agree that something ought to be done to correct existing faults in our income tax structure. We hope that this report of the National Industrial Conference Board will be called and recalled to the attention of those in whose power it lies to prescribe remedies.

Standardizing Tolerances in Machine Work

THE WORK of the American Society of Mechanical Engineers sub-committee on Plain Gages, so named to distinguish its work from that of the National Screw Thread Commission, is beginning to take definite shape in the way of tables of tolerances for various kinds of machine fits. These tables are the result of months of work on the part of the chairman, Col. E. C. Peck, and of his co-workers on this committee, who have spent hours of time in arranging tolerances to suit varying conditions.

In the tables are presented the practice of some of the best known concerns in this country, varying in some instances in order that a fairly uniform and logical increment can be used without going into unnecessary and impracticable decimals. They represent painstaking study of existing shop conditions in order to get tolerances which will stand the test of everyday practice.

Aside from making it easier to secure interchangeable work on an economical basis, the use of standard tolerances will tend to prevent errors, with the resultant waste in the form of scrapped material and labor. The use of standard tolerances will also go a long way toward avoiding disputes, litigation and loss, on contract work of any kind. For, just as we know what is meant by U.S.S. or S.A.E. standard threads, the use of standard tolerances gives definitely the grade of workmanship which is required. If a contract calls for Class I fits there can be no question as to the tolerance which can be taken, or that a greater variation from the dimension given will be cause for rejection.

The work of this committee deserves high commendation and the prompt adoption of its recommendations by machine builders will be of universal benefit.

Used Machinery for Export

IT IS RELIABLY reported that British machinery men have found a way around the foreign exchange obstruction. Our informant says that builders of machinery are purchasing used machines of their own make at the low prices current in the existing market, reconditioning them and disposing of them on the continent.

There are good features in this merchandising plan. In the first place the number of used tools on the local market is considerably reduced, thus improving the prospects for the sale of new tools. Then, too, work is provided for many machinists who would otherwise add to the imposing number of unemployed. From the manufacturer's viewpoint there is actual business in sight because the chances in favor of the sale of moderately priced rebuilt equipment to European countries with badly depreciated currency, are infinitely better than the chances for the sale of expensive new machines.

There is no question but that the new machine is far better than the old one but when the customer cannot possibly afford to buy the new one it is better to sell him the other than none at all. Such a procedure is admittedly an emergency measure for use only in times like the present, utterly disorganized by the aftereffects of the World War. When Europe's depreciated currency is back on a stable basis her manufacturers will be able to afford the kind of equipment they ought to have because they will not have to surmount the prohibitive barrier of abnormal exchange.

Is there a suggestion here for American machinery manufacturers?

An American Decimal System of Weights and Measures

SENATOR KING has introduced a bill intended to provide the United States with a decimal system of weights and measures. The bill is known as S 2070 and has several novel features. The one of most interest to the machine shop field is that the inch vanishes as a unit of length. It is replaced by a unit known as a "digit," which is to be one tenth of a foot, and is in turn divided into 10 lines or 100 points.

For many industries the foot as the basic unit will be entirely satisfactory. In the shop, however, where thousandths of an inch are the units commonly used, adoption of such a change would practically amount to a revolution.

Anyone who has ever worked in a machine shop could have told the politicians that too much oil is likely to fly around and spatter the bystanders.

Shop Equipment News

Davis "Rotormatic" Boring and Facing Machine

A continuously operating automatic boring and facing machine, known as the "Rotormatic," and intended for boring and facing operations on cylindrical parts, particularly Knight engine sleeves, is now being marketed by the Davis & Thompson Co., 253 Reed St., Milwaukee, Wis.

The machine, shown in Fig. 1, is of the horizontal type, with 12 spindles, six on each end. The machine will bore, face or thread the opposite ends of six pieces of work simultaneously, or will perform a single operation on each of 12 pieces simultaneously, as desired. Threading operations on work up to four inches in diameter can also be done. The machine is standard except for size and construction of holding devices, which can be designed to fit the work.

Clamping levers for holding the work are shown in Fig. 2, the clamps being opened and closed automatically, as the work nears or passes the loading station at the front of the machine. When closed they are held in place by means of heavy chains which can be seen in the rear view of the machine, Fig. 3. The chains are kept at the desired tension by four heavy coil springs at the top of the machine, as shown in Figs. 1 and 3.

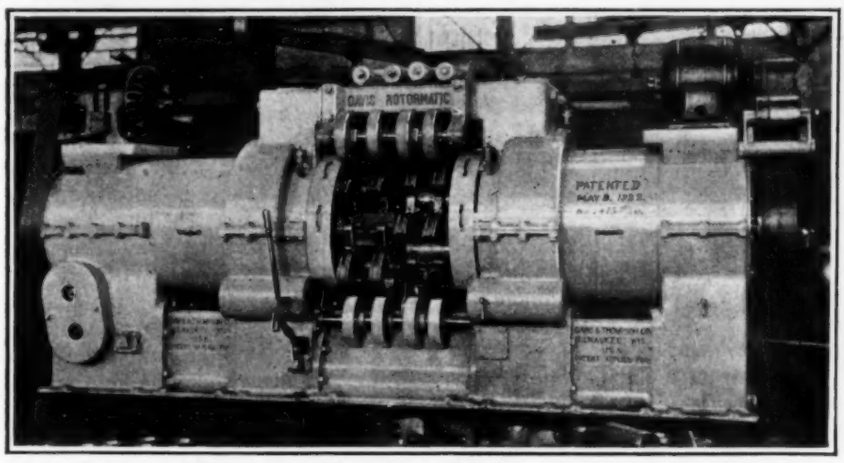


Fig. 1—Davis "Rotormatic" Boring and Facing Machine

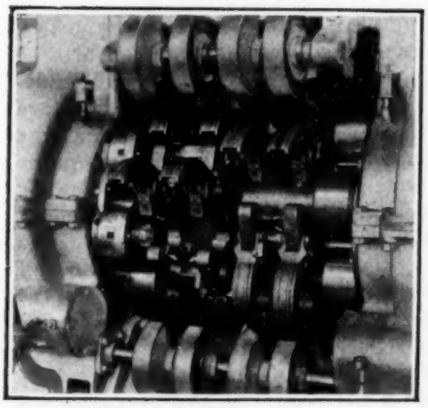


Fig. 2—Arrangement of clamping levers

The principal working part of the machine is the cylindrical turret, which carries the work and the spindles and revolves continuously. The turret does not index, but the tools operate continuously and perform 12 complete operations with each complete revolution of the turret. The tools are held in the spindles of the machine as shown in Fig. 2. The facing head has a range of movement of 2½ in. crosswise, while the boring tool can travel 14 inches.

The speed of the spindles in relation to the speed of the work drum is regulated by gears inside the drum. Two sets of gears are furnished, which makes it possible to obtain any desired relation of speeds. The sleeves are oiled by means of small cups attached to the rotating member of the machine and, as it travels toward the bottom of the machine, each cup dips in a reservoir of oil and eventually dumps the oil in an oil hole in the top of the sleeve. All oil that overflows falls into the cups below the sleeve.

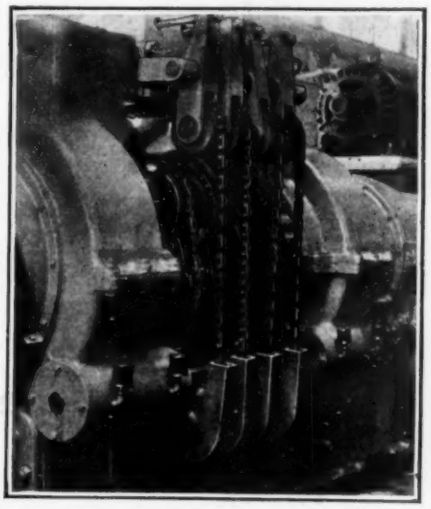


Fig. 3—Rear view of machine

The machine is of heavy type of construction to withstand the wear incidental to high production, and is built on the unit system which makes all parts easily accessible. The distance between ends can be varied to suit any size or class of work. Practically all bearings are lubricated automatically.

The boring tools are held in No. 5 Morse taper sockets in the spindles, the facing tools being held by setscrews in the facing head. The machine will bore work up to 7 in. in diameter and face up to 8 in. in diameter. The floor space required is 14x6 ft. and the weight is 30,000 pounds. If the material on which the machining operations are to be performed requires the use of cutting lubricant, a suitable pump and the necessary piping can be furnished.

Davis Automatic Pipe Cutter

An automatic machine, designed to cut off pipe nipples and similar parts at high speed, has recently been developed by the Davis & Thompson Co., 253 Reed St., Milwaukee, Wis.

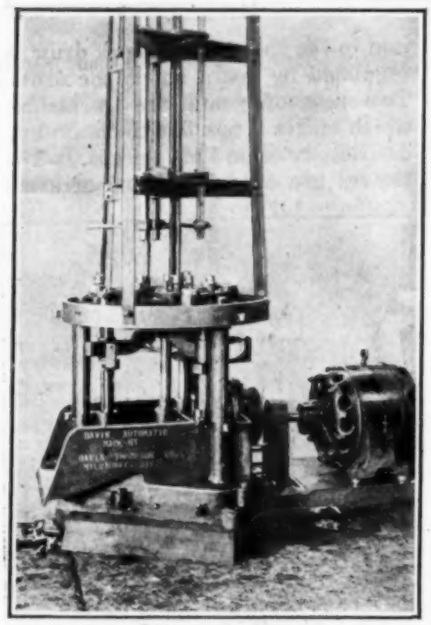


Fig. 1—Davis Automatic Pipe Cutter

The machine, which is shown in the accompanying illustrations, is of vertical construction and holds three sections of pipe, upon all of which operations are performed at the same time. The pipes stand in a vertical position, and are held in place by guides which allow the pipes to feed down to the tool by gravity. Each pipe drops down onto a stop which remains in position until the cutter is part way through the pipe, then the stop withdraws and allows the nipple to fall as the cut is finished. As the work is withdrawn from the cutter, the stop again moves into place so that the pipe will drop to the desired point.

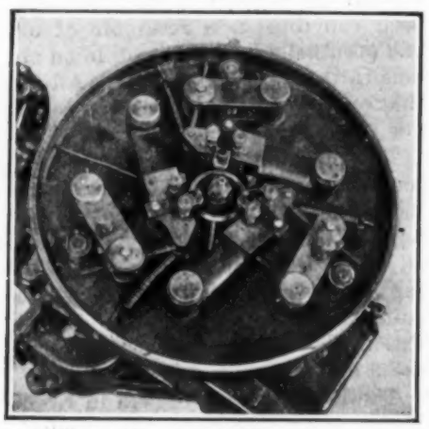
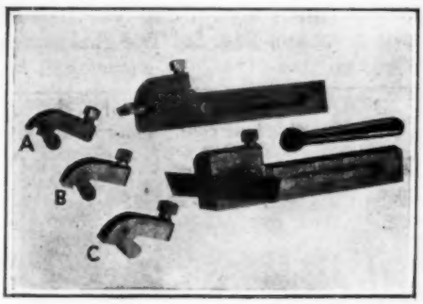


Fig. 2—View of table of machine, showing cutter and work

Only one cutter is used and is located on a spindle in the center of the machine table, as shown in Fig. 2. The work is fed to the cutter by the action of a cam on the top of the machine. The machine will cut pipe from ¼ in. to 2 in. in diameter and in lengths from one to eight feet. A production of 4,000 three-quarter-inch nipples per hr. can be obtained.

Jacques "Vise-Grip" Toolholder

The Central Tool Co., Auburn, R. I., has recently placed on the market a toolholder, designated the "Vise-grip," designed to hold very short pieces securely and therefore to enable the user to effect a saving of high speed steel by using the bits entirely up. Two styles are made; one to hold a cutting-off blade and the other to hold round, square or rectangular sections.



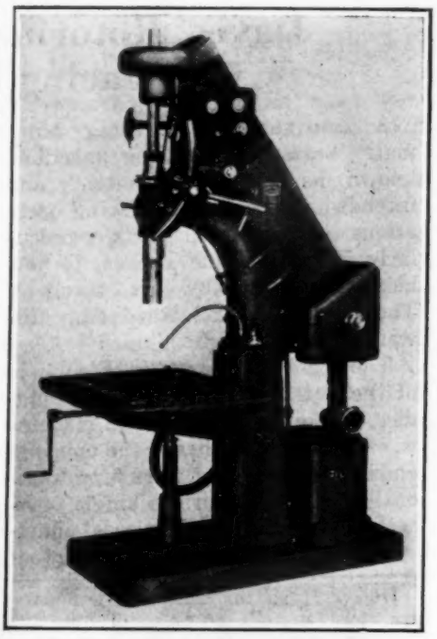
Jacques "Vise-Grip" Toolholder

With the latter shank one of four interchangeable jaws or clamping levers may be used, all of which are shown in the accompanying illustration. The jaw shown in place in the shank holds square sections parallel with the shank; jaws *A* and *B* hold square sections at an angle of 45 deg., right and left respectively; and jaw *C* holds round wire at a right angle or flat stock in any position. This is an especially valuable feature for use in connection with small forming tools for special jobs. The faces are serrated to increase the gripping power.

A single setscrew holds the jaw in place and clamps the toolbit. When the screw is loosened the jaw may be pushed sidewise in either direction out of the holder. It takes no longer to change a jaw than to change a toolbit.

Barnes Self-Oiling All-Geared Drilling and Tapping Machine

A drilling machine equipped with a rigid column and square table for jig work in production manufacturing is now being marketed by the Barnes Drill Co., 820 Chestnut St., Rockford, Ill., and is shown in the accompanying illustration. The machine is the same in every respect as the 24-in. "self-oiler," with the exception of the column and table. The table is gibbed to ways on the machine column, and is supported by a screw for adjustment of height.



Barnes Self-Oiling All-Geared Drilling Machine

Work can also be machined on the base of the machine, if desired, by removing the table. The base as shown in the illustration does not have a finished surface but it can be supplied, with T-slots, upon order. The square column type can also be supplied with a compound table if desired. The general specifications are the same for the 24-in. machine, the feature of which is the automatic system of oiling the gears and their bearings. Oil is pumped by a geared pump in the reservoir of the machine and distributed constantly to all bearings except the spindle sleeve and cross spindle.

A special geared thread leading feed will be furnished for the tapping machine, with slip gears to conform to the lead of the tap or die that is to be used.

News of the Week

President Hartness of A.E.C. Urges Engineers to Aid Government

Suggests re-organization for efficiency and economy

"There are evidences that our welfare as a nation and as individuals has reached its highest point under present conditions," former Governor James Hartness of Vermont, new president of the American Engineering Council, declared in an address at Hartford, Conn., recently before the Hartford section of the American Society of Mechanical Engineers.

Mr. Hartness said it was the aim of American engineers to place their services at the disposal of the government in all questions arising within their sphere. The immense modern significance of the engineer in both peace and war has made this step both natural and necessary, according to Mr. Hartness, who advocated the adoption of a broad plan of government reorganization.

He stressed the necessity of making over the Department of the Interior, described as archaic and unresponsive to national needs. The enormous public works functions of the government, he said, should be coordinated within this department, preferably re-named the Department of Public Works, thereby eleminating duplication of effort, overlapping of functions, and the waste of millions of dollars annually of the tax payers' money.

Fearing that the scheme of government reorganization embodied in the Brown Plan, approved by the late President Harding, will fail, the engineers, Mr. Hartness said, had determined to act in motion, in co-operation with more than sixty other national organizations, a nationwide plan to modernize the Department of the Interior, with which the vast engineering activities of the government are associated.

Economy and Politics

"We know that the government officials are not elected on a basis of fitness to control business, and that it is unreasonable to expect to get sound advice and wise decisions out of political discussions," continued Mr. Hartness.

"Economy of politics is not true economy. The term 'political economy' is more idealistic than natural. From the time of Adam and Eve there has been a desire to get politics and economy to pull together, but thus far they have refused to do so. In fact, they now seem to be pulling in opposite directions.

"Engineers will accomplish a great work if they succeed in reducing the war spirit that exists between the two opposing interests. The task is not hopeless; it is one that the engineers must assist in accomplishing."

The government is hampering industry, said Mr. Hartness, who attributed unrest largely to the restrictive tendencies of political action.

More Cars Are Ordered by Pennsylvania

The Pennsylvania Railroad System has placed orders for 11,000 freight cars, and is negotiating for 1,000 more. The equipment order calls for 3,000 all steel automobile cars, 8,000 all steel boxcars and 1,000 steel underframe stock cars.

Equipment orders placed by the Pennsylvania Railroad System for delivery this year will approximate $27,500,000. Of this total the 12,000 freight cars will cost, roundly, $25,000,000, and the 50 passenger locomotives which the company is building at its own works at Altoona, it is estimated, will cost about $2,500,000. Construction of the 50 locomotives was begun in January, and deliveries have already been started. It is probable that the Pennsylvania will finance the greater part of the cost of its new rolling stock through the sale of equipment trust certificates, a practice which has been followed by the company in the past.

French Auto Exports Show Gain

In spite of the general progression of the French automobile manufacturing industry there were imported in 1923 from the United States 7,264 units, 967 from Italy, 32 from England, and the balance of the 8,400 units from various countries, including 16 from Germany. The entered value was 58,207,000 francs as compared with a value of 45,289,000 francs in 1922.

Trucks and tractors were imported only to the number of 85 of which 41 were from the United States, 27 from Germany and one from England.

French automobile exports amounted to 28,261 units, which is in every way a remarkable showing. Great Britain appears to have taken the largest number, 6,992; Belgium-Luxembourg took 5,105; Spain took 2,964; the United States, 133; Japan, 320; Brazil, 29; Argentine, 153; and Canada, 16. The total value of these exports was 730,337,000 francs as compared with 403,700,000 francs in 1922.

Motor trucks exported accounted for 2,663 units, of which Great Britain took 246; the United States, one; the Argentine, 15; Brazil, three; Japan, two; and Spain, 443. The value was 81,864,000 francs as compared with 153,181,000 in 1922, which was as remarkable a decline as was the increase in pleasure cars.

The excess of the value of exports over imports of automobiles and motor trucks was 752,562,000 francs for the year. From this it is evident that French production methods are looking up, but it should be borne in mind that with respect to most figures given the bulk of the business has gone to the Renault and Citröen firms — at least they are the two big producers.

Automobile Schedules Are Increased

The Studebaker Corp. produced 12,600 cars in February, an increase of 4,793 over January. The March schedule calls for 14,500.

The Buick Motor Co. produced 36,500 cars in January and February, an increase of 12 per cent over the corresponding period of 1923.

The Dodge Bros. February output was 20,434 cars and trucks, against 19,900 in January.

Production figures of other motor car companies for February show the output on an increasing scale. The Ford Motor Co. produced 167,141 cars and trucks last month as against 161,933 in January. This is merely domestic production. Chevrolet produced 55,467 cars in February and 40,806 in January. A production of 65,000 cars is planned for March. This serves to give an idea of how every concern is prospering in this city.

Flanders and DuBrul in Rockford

Ralph E. Flanders, general manager of the Jones & Lamson Machine Co. at Springfield, Vt., and Ernest F. DuBrul, well known economist, were guests of Rockford, Ill., members of the National Machine Tool Builders' Association recently at a banquet at the Nelson hotel.

Mr. Flanders is national president. The visiting officials visited local factories on a tour of inspection. "How to Sell Machine Tools" was the subject of an address by Mr. DuBrul at the banquet.

Delegations from Beloit and Freeport associations attended.

Conference Board Voices Vigorous Protest Against Present Tax Methods

Inadequate systems and incompetent employees charged

Demands for drastic reforms in the administration of the Federal Income tax laws, supported by a recital of alleged abuses ascribed to the lack of more competent men in the Bureau of Internal Revenue, to a policy of secrecy in thousands of rulings, and to irritation to business interests at times forcing bankruptcies and the loss of millions of dollars, are made in a report issued Saturday by the National Industrial Conference Board for the information of Congress and the public.

The report was prepared by a committee of leading business men and economists, and is the result of several months of special study of the Federal system of tax administration. This study, the report asserts, has revealed conditions which have "so antagonized some taxpayers that they are led to indulge in similar tactics of delay and opposition which under other circumstances they would have hesitated to adopt." The report is to be widely circulated among leading industrialists immediately.

Appointment of a Congressional commission to investigate the abuses complained of is demanded in the report. Stress is laid upon the fact, as first developed by the conference board in advance of the Mellon plan last fall, that the nation's tax bill still eats up one-eighth of the income received by every man, woman and child in America, and that it has doubled in the last ten years.

"Tax Experts"

The practice of officials of the Government leaving federal service and becoming "tax experts" to "prey upon taxpayers largely as a result of conditions which they themselves have helped bring about" is also condemned.

Referring to the Mellon plan now before Congress, the committee points out in its report that it "touches only in part the simplification of the income tax machinery." Other major problems remain, it is asserted, and the whole tax structure requires intensive study and investigation by a competent body. "Only in this way," says the report, "can the country secure that thorough revision of the federal tax system which is needed in the interest of the national welfare."

The first recommendation among the seven listed by the committee demands a shakeup of the Bureau of Internal Revenue and engagement of more "high-grade, mature and competent men than it has at present." "At present," the report says, "there are too many immature, relatively underpaid men engaged in making assessments; men who lack the training and sobriety of judgment to do full justice either to the government or the taxpayer."

Characterizing the constant turnover of jobs in the Bureau of Internal Revenue as nothing short of a calamity, the report shows that while the staff of the bureau was only reduced in number by 36 in the last fiscal year, the number of employees quitting and succeeded by others was 1,193, and in the previous fiscal year 1,078 out of a total of 7,275. Many men stay in the government service only long enough, the report insists, to "learn the ropes" and then quit in order to get highly-paid jobs working for the very persons who have been taxed, and fight the very system "which they themselves had helped set up and administer."

The second recommendation reveals the congestion in appeals in the bureau. A Board of Tax Appeals should be created outside the bureau to dispose of these, it is asserted.

The other demands as outlined in the report, for each of which arguments are cited, are:

"It is highly essential that some scheme of administrative decentralization be adopted. Increased power to determine and settle cases as they arise should be vested in the agent in charge of local revenue offices.

"The business community on the whole is convinced that the practice of the bureau in seeking a waiver by the taxpayer of his rights under the statutes of limitation should be discontinued.

"It is urged that the law be changed so as to allow the giving of an adequate bond and the postponement of the actual payment until the appeal has been heard and determined. Bankruptcies in some instances have been precipitated by demand of the bureau for the payment of additional assessments.

"Central housing of the Bureau of Internal Revenue should be provided for, where adequate facilities will be available for having all employees under one roof, and for retaining and storing in a safe place all the original copies of taxpayers' contracts, documents, books, papers, etc., which have been sent to Washington at the request of the Government. The Internal Revenue Service occupies 630,000 sq.ft. of space widely scattered, 419,000 sq.ft. of this space being in temporary buildings erected for use during the war.

"Many complaints have arisen in connection with the unpublished and secret rulings of the Bureau of Internal Revenue. It is asserted that there is reason to believe that there are more than 4,000 of these rulings, only 10 per cent of which have been made known."

Willys Buys Small Branch Railway

Henry Ford's success with the Detroit, Toledo & Ironton Railroad has been the incentive for John N. Willys, of the Willys-Overland Motor Car Co., in the purchase of the Toledo & Western Electric road. The railway starts in West Toledo near the Overland plant and has terminals at Adrian, Mich., and at Franklin, Ohio. The Wabash system is touched at both places by the electric road and, it is stated by Mr. Willys, he has arranged with that road to handle shipments of automobiles and parts for distribution Southwest and East. The New York Central Railroad handles the Overland freight at the present time.

By this arrangement it is expected that the little electric road will be put on a profitable basis. J. E. Taussig, president of the Wabash, is vice-president of the Willys road, and John N. Willys is a director of the Wabash. The Toledo and Western has been in the hands of a receiver for the past three years and has been operated for thirteen years.

Industrial Research Work at Yale

Announcements were made by the Manufacturers' Association of Connecticut and Yale University of the development of a plan formulated by a joint committee of the two institutions for co-operation in industrial research and educational work.

The plan, it is stated, will enable industries of the State to obtain greater access to facilities of the university for scientific and technical work, and enable manufacturers to obtain more easily the services of technically trained young men.

The plan also contemplates a closer contact of the university students and teaching staff with the practical problems of industry and will enable students in vacation time to obtain the benefits of practical experience in the manufacturing plants of the State.

New York Central Head Accidentally Killed

Alfred H. Smith, aged 60 years, president of the New York Central Railroad, died suddenly Saturday, March 8 as the result of a fall from a horse. Mr. Smith with Edward E. Hoopes, freight traffic manager of the New York Central, was riding in Central Park, New York City, and in avoiding a collision with a young woman rider, was thrown from his horse when he pulled up sharply. His neck was broken and he died before medical aid could arrive.

Mr. Smith was born in Cleveland and started in his railroad career as messenger boy in the purchasing agent's office of the Lake Shore & Michigan Southern Railroad. Through diligence and hard work he advanced himself through many of the practical railroad jobs until in 1914 he was made president of the New York Central system. At the time of his death his salary was $100,000 a year, the highest salary paid to any railroad executive.

During the war, Mr. Smith acted as Assistant Director General of Railroads in charge of transportation in trunk line territory east of Chicago and north of the Ohio River.

Notes of Washington Activities

By Paul Wooton

The simplification of variety and the standardization of commonly used machine elements was advanced a long way as the result of a conference called by the Division of Simplified Practices of the Department of Commerce and held in Washington, Feb. 19 and 20. This conference, which was called at the request of the National Association of Farm Equipment Manufacturers, was attended by approximately 50 delegates representing manufacturers, distributors, consumers and general interests. The delegates of this association represented both of the first two groups, while the members of the Sectional Committee on the Standardization of Bolt, Nut and Rivet Proportions who were present represented twenty organizations which cover completely all three groups. Among the societies were: Society of Automotive Engineers, the American Society of Mechanical Engineers, the American Electric Railway Association, American Hardware Manufacturers Association, American Supply and Machinery Manufacturers Association, American Railway Association, National Machine Tool Builders' Association, National Association of Stove Manufacturers, Navy Department, the Railway Car Manufacturers Association, the War Department, and the American Society for Testing Materials.

As is generally well known, this Sectional Committee on Bolt, Nut and Rivet Proportions was organized and is functioning under the Procedure of the American Engineering Standards Committee and is sponsored by the S.A.E. and the A.S.M.E.

Before the conference had progressed very far it became evident that the work before it was not limited to merely the elimination of variety and sizes but involved the more difficult question of technical standardization. It can now be reported, however, that the number of plow bolts was reduced from an indefinite number to four. The form and dimensions of these four bolts as prepared and recommended by the farm equipment manufacturers were approved by the conference with slight modifications. These four approved plow bolts are those known as Nos. 3, 4, 6, and 7. Bolts Nos. 3, 6, and 7 have round heads and No. 4 has a square head. They have angles under the head of 80, 80, 40 and 60 degrees, respectively, and their nominal diameters are $\frac{7}{16}$, $\frac{1}{2}$, $\frac{7}{16}$, $\frac{1}{2}$, $\frac{7}{16}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, and 1 inch.

Trade Statistics and the Coal Industry

The uncertain status of trade statistics brought about by the activities of the Department of Justice has affected the coal industry seriously. It has all but disrupted the statistical activities of the National Coal Association. Since statistics are so essential to the intelligent conduct of the coal trade, the hope is that this industry may be able to bring about a clarification of the situation. Allen H. Willett, the director of the Bureau of Coal Economics of the National Coal Association, has called attention to the fact that the Department of Commerce and the Department of Justice are in deadlock and that the President might be induced to force the issue to a conclusion. A suggestion from another quarter is that a test case could be brought in a clear cut statistical case without the consent of the Department of Justice. It is understood that the Department of Justice has declined to initiate such a proceeding.

Manufacturers Bureau

In carrying forward plans for creation of a Manufacturers Bureau to be affiliated with the Associated General Contractors, as requested by prominent equipment manufacturers at a recent conference in Chicago and approved by the general contractors' convention, copies of the general idea of the project, together with excerpts from the remarks of the producers at the conference are being forwarded by the A.G.C. to a number of equipment manufacturers for their criticism and suggestions.

When these suggestions have been received and analyzed, the tentative plans will be revised and put in detailed form and copies will be sent to all equipment manufacturers in the shape of a pamphlet, asking their co-operation and support in the project.

As tentatively outlined in the proofs being forwarded for criticism, the proposed new division of the Associated General Contractors would serve as a clearing house for ideas as between equipment manufacturers and their customers, the contractors, and between the manufacturers themselves. Standardization of specifications for construction machinery and equipment would form a large part of the work. Collection and distribution of trade statistics also would be included among the functions of the proposed bureau, the statistics to be published in the established trade journals, with possibly a special section devoted to this purpose in the organ of the A.G.C.

Ought to Be Used to Them by Now

J. N. Ding in the N. Y. Tribune.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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THE decline in French francs to 3.75 on Friday was about the only unfavorable development in the financial complex last week. It is variously attributed to the tardiness of the French Senate in approving the increased taxes proposed by Poincare, to the raids of bearish speculators in foreign exchange and to the impatience felt by the French people at the moratorium proposed for Germany in the plan for settling the reparation question.

But it is not likely that the depreciation of the franc can work much harm in this country and in France itself the first effect will be the intoxication of further inflation and the creation of a fictitious prosperity.

Meantime General Dawes is working away at his plan, the corner stone of which is a "gold bank" for Germany, whose headquarters will be in Holland and whose directorate will be half German and half foreign, with one American nominated by the Federal Reserve Board. It is a practical and a common sense plan and it has a better chance of acceptance than any other yet submitted.

Great Britain is meanwhile working hard to recover her grip on the world's trade. Ramsay MacDonald's letter to the French Premier emphasizes the seriousness of her determination, which is further evidenced by the magnitude of the British Empire Exhibition to be opened in London April 23. It will be the biggest thing of its kind ever attempted. Its cost will be about $200,000,000. It will house more than 100,000 exhibits and an attendance of 250,000,000 persons is expected. All the hotel accommodations in London are said to be engaged and it is anticipated that the effect on British trade in particular, and world trade in general, will be highly beneficial.

Conditions abroad are considered first this week because we have reached a point in this country at which the rapidity of our development will slacken unless the buying power of Europe is speedily restored.

That Great Britain is working to this end with all her power and prestige should be encouraging to us as well as to Englishmen and it seems reasonable to expect an increased demand for our exportable production as the spring opens and the harvest season of the present year comes nearer day by day.

Turning our eyes from across the Atlantic to our Homeland, the outlook is entirely reassuring if the vagaries of the professional speculator are disregarded. Retal trade is generally good and the increase in sales reported by the mail order houses and the chain stores is really astonishing. Manufacturers and wholesalers are, however, complaining about the persistence of distributors in buying from hand to mouth. They say that it is a policy that dams up the supply at the source and that it is unfair. But it is at least a guarantee against distension and while it is continued no serious congestion or contraction is likely.

The railroad traffic keeps up amazingly and it is being moved with remarkable speed. This may explain the willingness of dealers to let their stocks run down. They know they can be promptly replenished.

The cotton goods trade is distinctly better. It seems to have found itself now that the decline in cotton has been checked. Woolen goods are also on an even keel, though carpets and rugs are being priced at the decline of about 10 per cent registered at the big auction sale held in New York last week.

The steel industry continues active and prices are stable. The mills profess to be well satisfied with the outlook. The production of pig iron in February was the largest of any month since October, 1920. Copper sold at 14¼ on a better demand that was quickened by talk of a curtailment in production. A slight reaction was recorded at the end of the week but a further advance is predicted by many.

There appears to be a real famine in tin which sold at £291 a ton in London and at over 56 cents a pound in New York. The other non-ferrous metals are firm, though zinc is a little below the top. Sugar was unchanged, but coffee touched the peak of the present upward movement. Some think the Brazilian government is overplaying its hand in witholding the supply and advancing prices. This view is probably sound, and wise merchants will buy as little as possible.

Corn is higher and wheat is unchanged, although it is expected that President Coolidge will issue a proclamation increasing the duty on foreign grown wheat. The Farm Bloc are working hard to secure the passage of the McNary-Haugen bill, which carries an appropriation of $200,000,000, to be used in buying up the surplus American wheat and paying the losses resulting from its sale abroad. A similar measure that has been brought to the front by the decline in cotton is the Dial-Lowrey bill authorizing the use of $150,000,000, now in the hands of Alien Property Custodian in financing cotton to be shipped to Austria and Germany. But it seems unlikely that either of these bills will be adopted until some tax reduction legislation is passed, and the latest advices are that the Senate will entirely rewrite the bill passed by the House. Talk of the bonus has also been revived, but the Washington news, though spicy in its personalities, has ceased to have much influence upon business.

The weekly statement of the Federal Reserve System shows no important changes.

What's Doing in Industry

Steady improvement in both sales and inquiries marks the machinery and machine tool business this week. Sales of importance to railroads and automotive manufacturers and for export have been made and production in most parts of the country is good.

The annual statements of metal-working and allied companies show excellent business during the past year.

Automobile production is ahead of the most optimistic estimates and indications are for further increases in schedules during the ocming month. However, banks are watching their credits, mindful of the overproduction of a few years ago.

Iron and steel are going along on a fairly even production basis and orders will keep mills busy for some time to come.

Business has improved to a marked degree in the export lines. Foreign countries are purchasing more than last year at this time and further purchases are indicated.

General business conditions are good but uneven, with the Northwest behind the other sections of the country.

The stock market has been quiet during the past week with but few changes recorded.

The Industrial Review

What the year has yielded and some predictions for next year's production

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Canada

A demand for machine tools, especially in eastern Canada, has been noted during the last two weeks. Owing to heavy orders from the railways, steel mills and foundries are unusually active. Automobile plants generally are showing increased production, and preparing for a large distribution during the next few months. Activity in the automobile industry is reflected in exports of freight vehicles during January, which totaled 1,775 valued at $619,355 as compared with only 369 valued at $141,261 in January, 1923. Imports of parts from the United States during January totalled in value $1,329,000, an increase of $280,000 over the previous month.

The demand for merchant mill products continues steady, though industrial consumers are buying only for immediate needs. United States purchases of pulp and paper continue to show remarkable expansion, and as a result the mills are all working at capacity.

Among the fiscal changes intimated in the speech from the Throne at the recent opening of the Dominion Parliament were reductions in the customs tariff on agricultural implements. The proposals are being vigorously opposed by Canadian dealers.

During February general freight movements over Canadian Pacific railway lines increased 15.2 per cent over the corresponding period of 1922. The Montreal Tramways Commission has placed an order for additional equipment with the Canadian Car & Foundry Co., Ltd., to a total value of $427,500. The new order includes a contract for fifty cars.

Chicago

Machinery and machine tool buying in the Chicago district during February showed a considerable improvement over January, and some dealers report February sales as being about seventy-five per cent better than January. During the past week there has been greater activity on the part of industrial companies. The Santa Fe Railway now has outstanding an inquiry for more than a hundred tools, but is not expected to start purchases during March. Dealers believe that the bulk of March business in this territory will come from industrial companies.

The P. B. Yates Machine Co., Beloit, Wis., has placed orders with Chicago dealers for one vertical milling machine, one 3-ft. radial drill, two upright drilling machines, two turret lathes, two planers, one No. 4 plain milling machine, two hand screw machines, a special horizontal boring mill, and two thread milling machines, involving an expenditure of $38,500. The Oliver Iron Mining Co., Duluth, Minn., has placed orders for three Ryerson lathes. The Falls Motor Corp. is reported to have placed orders for a crank turning lathe, one boring mill and one multiple drill. The Hart-Parr Co., Charles City, Iowa, has placed orders for sheet metal machinery involving an outlay of about $3,500. The Fairbanks-Morse Co., Beloit, Wis., is said to be anticipating the purchase of new equipment for its machine shops.

Milwaukee

Industrial activity in the Milwaukee manufacturing area is now giving evidence of growth which is interpreted as forecasting a steadily improving call for metalworking tools. Local dealers have been making a moderate number of sales in the past two months, but business has hardly reached the proportions of the same months a year ago. Inquiries that have been received so far in March indicate that demand is about to seek a better and higher level. Inquiry is running more toward small lot business.

Builders of metalworking equipment in this market feel more encouraged than for at least six months by inquiries from such principal production centers as Detroit, Chicago Cleveland and New England. Automobile shops remain the high light and some of the principal groups find need for heavier output, making the call for machinery pass the purely replacement stage.

Electrical appliance and radio manufacturers are inquiring freely, although their purchases have been light so far this year. The radio industry has fallen so far behind orders that expansion of factories seems imperative, inasmuch as close analysis of market potentialities reveals nothing to indicate that radio is purely a "fad" that may pass with the same speed that marked its rise to popularity.

Detroit

Preparations for the greatest competitive year in the automotive industry ever known are having a tremendous effect upon the machine tool industry as executives demand of their engineers the most efficient methods of production.

Realization that labor-saving machinery counts for more during the inevitable competition among the leaders in the automobile field for supremacy, is bringing joy to the hearts of salesmen in the field who report numerous substantial orders for machinery.

So far the advance in prices announced by eight concerns has not had an immediate effect upon production. With six or eight further advances predicted within the course of another month or so, there is every appearance that the motor car has reached its greatest money value for some time.

Encouraging reports from the railroads who report business exceeding that of any other season adds to the optimism which prevails in this section.

Indianapolis

Though there are indications of some increase in business, the demand for machine tools continues rather disappointing. Business in special machinery for those branches of industry that look for a good spring, is picking up rapidly. During the last week manufacturers of marine machinery had representatives visiting both northern and southern Indiana for lake and river business. They report an increase.

Judging from the increased number of inquiries both for machine tools and special machinery, the railroads are expecting to begin their spring repair programs shortly. Some of the independent car factories of the state already have received advance orders and are putting men to work. Some of the railroads having division offices here have their mechanical engineering departments working overtime on proposed improvements in motive and rolling stock. One road in particular has had men visiting the various shops in the division to make sure everything was in readiness for spring repair work.

Local automobile and allied industries are increasing their production schedules and it is from this source most of the tooling demand comes.

Southern District

February volume showed a slight improvement over January in the South, and was about on a par with the same month in 1923, an encouraging report when it is considered that the first three or four months of last year were unusually good.

Railroads continue the heaviest buyers, taking considerable heavy equipment for shop use, and inquiries still are in good volume from this source. Sales to railroads are 15 to 20 per cent better than early last year, and bid fair to remain so.

Another excellent buyer is the automotive industry in the South, with which a considerable volume of business is being booked, principally in lathes, drill presses, planers, and smaller equipment for garages and service stations. In January and February this industry established the biggest record in the South's history in construction of new service stations

and garages, and there will continue a big potential market here for an indefinite period.

Smaller machine shops are about as active as a month ago, doing a fair amount of buying of smaller tools, the volume being somewhat larger than it was three or four months ago. The outlook here is very good.

Textile industries are again inactive due to recent curtailment occasioned by slack demand for cotton goods, and are buying very few tools, though inquiries that will develop future business are fair. Conditions in this industry have been spotty for several months.

Considerable business in second hand tools is reported by the trade, with smaller machine shops and service stations and garages principal buyers.

Export volume is fair, Cuba being the principal buyer, the outlook portending a better export volume than last year.

New York

Buying during the first few days of March has been better than it was during the early days of the other two months of the year and as good as during March, 1923, when business was considered very good. Inquiries also continue to come in and dealers in the Metropolitan district are well pleased with the showing so far in 1924. Automobile parts makers are good buyers as well as the railroads that buy in the East.

Japanese business is beginning to materialize and heavy ordering is expected during April. The big electrical manufacturers are continually buying new equipment which has added to the general good condition in New York.

Prosperity Is Shown by Annual Reports

The American Steel Foundry Co. issued its report for 1923 showing the largest profit for any year in the history of the company. The net profits for 1923 after all deductions were $7,595,944, compared with a previous record of $5,025,666 reported in 1917. After allowing for dividends on the preferred stock the net was equal to $9.67 a share on the 722,196 shares of common stock outstanding. In 1922 the company earned $4.03 a share on the same amount of stock. The general balance sheet shows net current assets of $23,900,797 against net current liabilities of $3,766,645.

American Brake Shoe & Foundry Co., earning statement for the year ended Dec. 31, 1923, shows net profit of $2,727,097, after charges, depreciation, and Federal taxes. After deducting preferred dividends on subsidiary stocks and preferred shares, these earnings are equal to $13.35 a share on 154,160 shares of no par value, common stock, and compare with $2,120,539, or $9.60 a share on 151,238 shares of common stock in 1922.

At the meeting of the board of directors of the Bucyrus Co., held in Milwaukee, an additional dividend of 1 per cent and the regular quarterly dividend of 1¾ per cent were declared on the preferred stock. Both are payable April 1 to stockholders of record March 20. The additional dividend is apparently for account of accumulation which aggregates 9 per cent.

Net earnings of the company for the year ended Dec. 31, 1923, total $1,299,932, after taxes and depreciation. This amount is equal to $32.49 a share on the preferred stock and compares with $746,301, or $18.66 a share, earned in 1922.

Efforts to reduce the cost of production and sales, although against the odds of a declining raw material market, apparently were successful in the case of the Graton & Knight Manufacturing Co., tanner and leather belting manufacturer, Worcester, Mass., which showed a profit of $269,000 in 1923, according to the annual report made to stockholders against a profit of only $14,000 in 1922 and a loss of $4,865,000 in 1921. The profit amounts to $4 a share on the preferred stock. The company also reduced its liabilities last year to $3,745,000 from $4,349,000 at the end of 1922. It also made an investment of about $200,000 in plant improvements last year.

Worthington Report

The income of the Worthington Pump and Machinery Corp. for the year ended Dec. 31 amounts to $1,670,850 after interest, depreciation, and Federal taxes. This is equal after preferred dividends to $5.08 a share on $12,992,149 common stock, and compares with $879,685, or $4.73 a share earned on $10,321,671 Class "B" preferred stock in 1922.

The net profits of the Lima Locomotive Works, Inc., during 1923, as shown by the annual report, amounted, after reserve for Federal income tax and contingencies, to $2,402,604, equivalent to $11.24 a share on the common stock after payment of preferred dividends. The net income during 1922 amounted to only $175,446, and, whereas last year $1,562,709 was transferred to surplus, there was a deficit in 1922 of $144,750 after payment of dividends.

Gross sales for the year amounted to $20,286,867, other income raising gross income to $20,397,636, which compared with $6,476,953 in 1922. The balance sheet as of Dec. 31 shows cash in hand of $1,434,018 and total current assets of $7,911,195, against current liabilities of only $1,527,606.

The net profits of the Willys-Overland Co. for 1923, as shown by the annual report, amounted to $13,034,032, the largest in the company's history. They compared with net dividends in 1922 of $2,779,831 and a deficit in 1921 of $13,999,494.

The company had current assets on Dec. 31 last of $37,468,977, contrasted with current liabilities of $6,916,572, a ratio of 5.4 to 1. The company at the close of 1923 had no bank indebtedness. The first mortgage 7 per cent gold notes, maturing Dec. 1, 1923, amounting to $17,357,500, were entirely paid off in July.

Sales last year totaled 196,038 cars, more than 50,000 cars in excess of the previous largest year in the history of the company.

Business Items

The Pittsburgh office of the Niles-Bement-Pond Co., New York, will be moved April 1 from 425 Seventh Ave. to the Empire Building, 503 Liberty Ave.

The Miami Tool & Die Co., Dayton, Ohio, has appointed the D. S. Slusser Sales Co., Detroit, sales representative in the Detroit district.

The J. F. Buhr Machine Tool Co., Detroit, Mich., has taken over the manufacture of multiple drillers and tappers formerly made by the Nelson Blanck Manufacturing Co., Detroit, Mich., which is now being dissolved.

The General Electric Co. moved the headquarters of its East Central district from Cincinnati to Cleveland on March 1. In the latter city, combined with the local Cleveland office of the company, it will be located in the new Union Trust Co. building. The local office has already been moved to the new location.

The American Bosch Magneto Corp., Springfield, Mass., has just completed a new building for its Detroit branch at 89-95 Hancock Ave., West.

The Grinding Process Tool Co., Detroit, Mich., has been taken over by the Cogsdill Manufacturing Co., Detroit, Mich., and has been moved from 2614 West Warren St. to the new plant of the Cogsdill company, 6511 Epworth Boulevard, Detroit. R. G. Lamb will continue as general manager of the Grinding Process Tool Co.

The Canadian government has granted incorporation to the Stearns Canadian Knight Motors, Ltd., which is capitalized at $1,000,000 to manufacture automobiles, trucks and motor vehicles of every description in Montreal. The principal incorporators are Albert Bellemare, machinist and Paul Goulet, accountant, both of Montreal.

The Iron Products Corp., LaCrosse, Wis., manufacturing guy anchors for transmission line poles, well-drills and similar specialties, has purchased the entire business of the Crouse-Hinds Co., Syracuse, N. Y., manufacturing guy-anchors, conduit and other electrical fittings. The machinery is being moved to LaCrosse, and the Iron Products Corp. is supplementing this additional equipment by the purchase of two new forging hammers and miscellaneous machinery.

The plant of the Valley Bronze Co., in North Agawan, Mass., was partly destroyed by fire March 6, origin being undetermined. Loss to building, equipment and patterns is estimated at $15,000. The plant will be restored.

The Buckley Foundry Co., in Roseland Street, Springfield, Mass., manufacturer of brass castings, suffered approximately $6,000 loss from an explosion in its plant Feb. 26, due to molten metal running into a pool of water underneath a melting furnace. The accident occurred just at the close of the day's work, and no employee was injured.

Personals

JOHN D. BIRD, for fourteen years general manager of the Worthington Pump & Machinery Corp., Cudahy, a suburb of Milwaukee, Wis., has been elected president of the American National Bank of Milwaukee. E. J. KEARNEY, secretary-treasurer of the Kearney & Trecker Corp., machine tools, who has served as president of the bank for several years, has been elected to a new office of chairman of the board of directors. Mr. Bird also is president of the Cudahy State Bank.

EARL E. WATSON, formerly efficiency engineer of the Peerless Motor Car Co., Cleveland, Ohio, has joined the organization of Fairbanks, Morse & Co., Chicago, Ill., as superintendent of the time study division.

FRED J. MILLER, formerly editor of the *American Machinist*, and an ex-president of the American Society of Mechanical Engineers, has just been appointed a member of the Public Service Commission of Pennsylvania by Governor Pinchot. Mr. Miller resigned as engineer member of the Pennsylvania Water and Power Resources Board to accept his present position.

DONALD M. VANCE, formerly with the National Screw & Manufacturing Co., Cleveland, has been made publicity secretary of the Community Fund of Cleveland.

JOHN K. LIGHT, for several years connected with Joseph N. Smith & Co., Detroit, has been appointed manager of the Detroit territory of the Root Co., Bristol, Conn.

HORACE W. GILLETT has been appointed chief of the Metallurgical Division of the Bureau of Standards, succeeding DR. G. K. BURGESS, who was appointed director of the Burcau of Standards sometime ago.

A. D. BACH has resigned from the Cleveland office of the Atlas Steel Corp., Dunkirk, N. Y., and has joined the organization of Henry Disston & Sons, Inc., Philadelphia. He will be in the steel sales department in the New England territory.

W. H. CRITTENDEN and W. B. GIVEN were elected directors of the Bucyrus Co., Milwaukee, to succeed W. H. Marshall, deceased, and Andrew Fletcher, who resigned.

T. J. MCANDREW will have charge of the newly opened Philadelphia offices of the Poldi Steel Corp., New York City. The headquarters will be in the Otis Building.

FRANK J. MCGOUGH, formerly production manager for the Standard Screw Products Co. has resigned to take charge of personnel for the Detroit Motorbus Co.

HARRY A. SHUPTRINE, engineer of the road commission of Wayne county, and a resident of Detroit, has been elected president of the Michigan Engineering Society. Other officers were Harry Bouchard, vice-president; W. L. Hudson, treasurer, and George Ames, director at large.

THEODORE A. E. BARTHEL has been appointed secretary and treasurer of the Columbia Motors Co., Detroit.

HENRY T. WHEELOCK, formerly advertising and publicity manager of the Velie Motors Corp., Moline, Ill., has resigned and will assume active management of the Dean Motors Co., Velie distributor in the Rock Island, Ill., territory.

STEWART ROGERS has been made experimental engineer of the Fairbanks, Morse & Co., Chicago. He was formerly master mechanic of the Harrisburg Coal Mining Co., Harrisburg, Pa.

Obituaries

GEORGE FRANK KONOLD, aged 59 years, died recently in Warren, Ohio. He was head of the Warren Tool & Forge Co. Previous to 1911 he was superintendent of the Iron City Tools Works of Pittsburgh that he had been connected with for 23 years.

SAMUEL W. WATKINS, who served as president of the National Brake & Electric Co. and National Steel Foundries, Milwaukee, in the early days of these affiliated industries, died March 1 at his home in Clearwater, Fla., at the age of 68 years. He moved his residence from Milwaukee to Florida in 1914.

CHARLES A. COLLINS, aged 34 years, died recently in the West Suburban Hospital, Oak Park, Ill. He was the manager of the Federal Foundry Supply Co., Milwaukee, Wis.

HENRY P. WESTCOTT, aged 46 years, died recently in Seneca Falls, N. Y. He was the president of the Westcott Valve Co., Seneca Falls.

WILLIAM KEATING, founder and president of the Keating Brass Manufacturing Co., died at his home in Toronto, following a long illness.

LE ROY BEARDSLEY, for twenty years treasurer of the Chicago Pneumatic Tool Co., died March 5, 1924, in his home in Riverside, near Chicago. He was 72 years old. Mr. Beardsley had been in poor health since 1918, when he retired from business. He belonged to the South Shore Country Club, of which he was a charter member, and the Union League Club.

Canadian Car Orders

Announcement is made by the Canadian National Railways that orders have been placed as follows:

Canadian Car & Foundry Co., Montreal, 400 sixty-ton box cars; National Steel Corp., Hamilton, 400 sixty-ton box cars; Eastern Car Co., New Glasgow, Nova Scotia, 200 sixty-ton box cars; Canadian Car & Foundry Co., 150 fifty-ton convertible ballast cars. Hart-Otis type with side and center dumps, also fifty cabooses, to be built in the company's plant at Amherst, Nova Scotia; Eastern Car Co., 500 general service fifty-ton freight cars; National Steel Corp., 20 all steel baggage cars; Canadian Car & Foundry Co., 20 first class passenger coaches and 15 mail and express cars.

Automotive Exports Gain in January

Every class of passenger car witnessed a large increase in shipments abroad, according to the Automotive Division of the Department of Commerce. Leadership was taken by those valued up to $500, which advanced from 2,099 in January, 1923, to 4,734 in January, 1924. The class valued from $500 to $800 and $800 to $2,000 approximately doubled their shipments, but those over $2,000 increased only from 204 to 281.

Exports of trucks grew in like measure to passenger cars, but the chief advance was made in the heavy and higher priced machines. Trucks up to one ton, which were shipped in January, 1923, to the number of 1,095, increased in January, 1924, to 1,191. Those weighing from one to two and one-half tons increased from 205 to 355 and those over two and one-half tons from 52 to 145 cars.

Australia is still the chief market for American passenger cars, taking more than three times as many in January, 1924, as in January, 1923. Argentina took second place in the first month of the present year, rising from tenth place in 1923. Japan stood first in the purchases of trucks, her imports of American-made machines increasing from 10 in January, 1923, to 1,245 in January, 1924. This increase, which is due to the demand resulting from the destruction of vehicles in the earthquake and which has continued since September of last year, is the most noteworthy item in the export statistics in January. It is interesting to note that although the truck shipments to Japan in December dropped to 841, from the high mark of 1,859 in November, the January shipments brought them up again to 1,245 trucks.

Westinghouse Offers New Stock Issue

Westinghouse Electric & Manufacturing Co. has announced an offer of $17,955,000 par value additional stock to common stockholders of record March 17, 1924. The offering price is $52.50 a share. The company has declared a stock dividend on the common issue of 10 per cent, payable to holders of record May 2, 1924, so that the new stock offered for subscription will receive the stock dividend also.

The company's present capitalization comprises $3,998,700 seven per cent cumulative preferred stock outstanding ($50 par) and $85,776.450 common stock ($50 par) outstanding.

Taximeter Companies Merge

Following negotiations that have covered several months, announcement was made recently that the Ohmer Fare Register Co., of Dayton, Ohio, had acquired the entire business of the American Taximeter Co., of New York City. The manufacture of recording devices previously carried on by these two companies is to be concentrated at the plant of the Ohmer Fare Register Co. at Dayton.

Italy Plans Busy Industrial Future By Export Development

Spain and Russia both will be good customers

If the situation in Italy is not brilliant it may at least be said that the future is. From a low level of around 80 French francs for 100 lire, Italian currency has risen to 95 francs for a hundred lire since the first of the year. The government persecution of capital in industry has been obviated by strenuous measures of the Mussolini cabinet and a commercial expansion at home and abroad has come into being as a result and also from the reduction of customs dues on certain raw and semi-raw materials needed by industry.

In November a royal decree instituted what are to be known as "industrial observers," a class of functionaries who are charged to control and report on the conduct of certain major industries and make known their desiderata where customs dues or taxation laws are actually a handicap to their progression. Incidentally this amounts also to a cataloging of industry that it may be available in case of economic or political crisis. These observers are to the number of fifty and are to have free access to any establishment at whose door they may knock. It is doubtful, in spite of the "royal decree" if such a regime could be brought into force without a dictator and, while it certainly is not to be advised generally, there seems little doubt but that it will work admirably in Italy at this time.

There has been little labor trouble save in isolated and minor cases in the machinery and metal trades. In the automobile industry, notable progress has been made toward welding the interests of employer and workman. Such imports of raw and semi-raw materials as the metal industries require have bulked more largely from France than from any other country, England coming second. Only with steel plates and sheets does the United States draw up on England. Wages in the metal trades are undoubtedly downward compared with what they were during the laborers' hey-day of just after the war. The evening-up appears to have been accomplished with little disturbance to one element or the other. The example of the Fiat automobile plant is typical. A reduction of 20 per cent was operated during the year, four cuts of 5 per cent each every quarter.

Signs of Progress

During the last month of the year there were formed in Italy 99 new public companies with a total capital of nearly fifty million lire and during the same period 76 companies augmented their capital by 134 million lire.

A significant fact is the establishment of a new order to be known as the Star of Merit of Labor. Whatever the psychology or politics of the thing may be, it is certainly an effort to raise the dignity of labor. Like many other recent Italian innovations it appears to be a stimulating thing so it is not to be criticized. Skill and trustworthiness being the qualifications it should serve as an example to the youth of Italy.

The Workers' Fascisti Trades Unions meeting in November stated that for the most part manufacturers were in accord on the principles which would reduce production costs by all means and that if need be at the expense of the new government's ideals. Manifestly this is little more than an opposition political move and is entirely disproved by the apparent prosperity in most manufacturing lines. Significantly it is to be noted that shipbuilding actually going on in Italian yards is in excess of that in France and that the Italian automobile industry is almost without exception in a more healthy condition than is the case in France.

As a result of the journey of the King of Spain to Italy in the last weeks of the year, a commercial treaty was arrived at between Italy and Spain which at least points to a form of commercial co-operation. Italy has not a pound of coal for instance, whereas Spain has an excess for export amounting to well over a million tons. This might indeed be worth while for Italy's industries. A consortium Italo-Hispano will divide export territory for their wines, fruits and olive oils. Spain will place as much business as possible for Italian manufactures instead of sending the same business to France—franc and lire exchange being practically equal. From the French point of view, the circumstance is pregnant with possibilities, even political possibilities of the near or remote future. Italy, too, since the first of the year has signed a treaty with the Soviet government. This means business in Italian manufactures and hard wheat from south Russia for Italy's macaroni. European political and industrial platforms are built today on the foundation of reciprocity.

Italy has sent a floating sample-room to sea—the "Italia," where are displayed its varied manufactures running from motor cars to sewing machines and aeroplanes, marbles, textiles and straw hats. The South American market is especially aimed at. The ship will cruise 23,000 miles and touch at thirty South American ports.

Italy exported to France in 1923 to the value of 1,223,758,000 gold lire as compared with 803,587,000 gold lire in 1922. Italy's imports from France during the same respective periods were 1,181,352,000 and 797,090,000 gold lire. This shows a consistent progression and indicates also the fact that the Italian situation is immeasurably superior to that of France in that it has risen from a lower financial and trade level since the armistice.

Metallurgical Industry in France Presents Interesting Study

The future depends upon a multitude of circumstances

Just what the next few months are to bring forth in the French metallurgical industry is a problem which economists, politicians and industrialists are trying to solve in France.

The pig iron output in 1913 was 5,299,581 tons and in 1923 was 5,207,000 tons. The steel output in 1913 was 4,976,869 tons and in 1923 4,687,000 tons.

The showing might be thought excellent, even remarkable until it is recalled that the 1923 figures include the product of that magnificent battery of iron and steel plants erected by the Germans in what is now re-annexed Lorraine. Revised, these figures would fall in the neighborhood of a million and a half tons each. France is likely to be some day in the situation of being unable to use all of her production resources, or if she does use them she will be unable to market the product, either at home or abroad. If judgment was to be passed on the future of the French agricultural machinery industry or the electrical machinery industry, the case would be different. It is more serious since it starts from the base.

French metallurgy is generally conceded to betray a manifest incertitude. The price of blast furnace coke is still at the rate of 143.50 francs per ton at the frontier of the Ruhr as compared with the per-equation figure of 220 francs, a difference of sixty to seventy francs which has yet to be confirmed or rejected by the government commission which regulates the price.

Exports of finished products from Nancy and the Lorraine plants hold up well with the home market which may be considered as mildly satisfactory. Producers are not inclined to make concessions to speculators or manufacturers who might be disposed to stock for future manipulation.

With pig iron the situation is very unstable, 380 francs per metric ton being asked for February deliveries (a rise of 7.50 francs from January) for chill cast No. 3. Hematite pig is firm at 460 francs, a figure which runs close to that of quotations on English hematite.

Semi-finished products have been shipped to England in small but satisfactory quantities in the past weeks—blooms at 460 francs and open hearth billets at 500 francs.

Rolled products are an enigma. Large orders ahead can be placed at 530 francs the ton with a prominent Moselle plant, while smaller tonnages command of the same firm 570 francs. Obviously the concern is looking for book orders rather than deliveries from

stock, which at least shows some confidence on the part of the concern in question as to the probable turn of events. The viewpoint is optimistic.

Thick and thin sheets, as ever, are in demand in excess of production in France, as are ship plates. Wire is causing no concern, but French producers have still to contend with the more complete and efficient wire drawers of Belgium, where before the war and in the few months just after the armistice, there were in operation the only American wire making machinery on the continent.

Freight Costs

Transport by rail is a factor which tends to further raise the cost of metallurgical products in every phase of their variety and output to the consumer. A Commission now sitting in Paris proposes to raise railway freight rates 12½ per cent and passenger rates 50 per cent, with every probability that the proposition will be accepted. Whether the heavy metallurgical industries and chemical industries will be able to secure preferential rates remains to be seen, but the incident adds another element to the uncertainty of the situation in the metal trades of the moment. As the Marquis de Dion, the head of the great automobile firm which bears his name, has said: "There are two policies open to France: to produce more and thus increase its prosperity, or to produce less and thus save on its expense account for wages and overhead." The latter solution would appear fatal.

Tonnage Best Export Barometer

There was a notable reduction on pig iron exports and iron and steel during the year, readily accounted for when production, trade and political conditions are considered. This proves after all that real progress as to exports is only marked by increased tonnage when comparing figures of various years during a period of rising market prices, or, as in the case of France, a continually depreciating currency unit in which big and little business is figured.

The falling off in export pig iron is accounted for by reduced shipments to Germany and to England, those to Belgium actually having increased.

Semi-finished and rolled products have increased with the exception of the reduction of virtually two hundred thousand tons in shipments to Germany. Belgium increased her takings in these lines by 30 per cent, England by 100 per cent and "other countries" by 100 per cent.

Fabricated articles of metal (iron and steel) progressed to 51,573 metric tons from 32,980 tons the year before, and wire to 34,726 tons from 14,995 tons. Rails reached 246,258 tons, advancing from 178,491 tons.

Finished products are thus shown to have increased their exports while semi-finished products have declined. This is considered good business economics on the continent of Europe and is in fact the policy which has enabled little Belgium to build up its intensively conducted metallurgical industries. That France should take a leaf from the book of Belgium at this time is not surprising.

Belgium's Foreign Trade Improves

The Belgian Minister of Finances has issued his annual report on Belgian foreign trade for the past year showing an excess of imports of 3,675,000,000 francs over exports. The exact figures are 8,889,776,000 francs for the exports and 12,563,000,000 francs for imports. Raw materials for industry were imported to the extent of 5,509,000,000 francs and manufactured articles for 3,510,000,000 francs. The rosy aspect of the situation is that manufactured articles to the extent of 5,370,000,000 francs were exported, as is in line with traditional Belgian policy.

Trade exchanges with the United States showed a balance against Belgium of 1,141,000,000 francs. It is to be noted that American automobiles accounted for 112,344,000 francs, as against which automobiles imported from France (the country next in line) were for but 84,740,000 francs.

During the year Belgium and Luxembourg imported from France machinery to the value of 158,000,000 francs and iron and steel to the value of 134,000,000 francs. Belgium and Luxembourg exported to France coal to the value of 356,000,000 francs, machinery for 109,000,000 francs, iron and steel for 81,000,000 francs, and zinc for 70,000,000 francs.

Many Motor Coaches on Railroads

While only 40 railroads were listed last year as operating motor rail coaches, a compilation made on Jan. 1, 1924, shows a total of 157, or an apparent increase of about 400 per cent. These figures indicate that the railroads of the country are not only using the motor coach in an experimental way, but many of them have already found that it is practical and economical.

Among the latter may be numbered the New York, New Haven & Hartford R.R. It began a test of the motor rail coach about two years ago. Three motor rail coaches, each accommodating 30 persons and providing space for 1,000 lb. of baggage, were placed in the service. As a result of the success of this venture, a larger type of gasoline propelled vehicle, providing accommodations for 60 passengers and 2,000 lb. of baggage, was also placed in service. This is propelled by a 120 hp. 6-cylinder motor.

This larger unit has so proved its worth that the New Haven road has recently orderd 10 new units of the same type. These will be placed in service as soon as they are delivered.

Trade Catalogs

Small Tools. The Whitman & Barnes Manufacturing Co., Akron, Ohio. The stock list and market letter of this company for February has been issued. All of its products are listed.

Vises. The Charles Parker Co., Meriden, Conn. The various vises with weight, size and list price are shown in this catalog. Specifications and sectional drawings are shown also.

Hardness Tester. The Wilson-Maeulen Co., 383 Concord Ave., New York City. The Rockwell direct-reading hardness tester, made by this company, is described by text, illustrations, charts, and sectional drawings. The booklet also contains a list of users of the tester.

Wire Stranding, Cabling and Armoring Machines. The Watson Machine Co., Paterson, N. J. This is a book of illustrations showing the company's products. Captions and some descriptive matter accompanies each half-tone cut.

Direct-Current Transformers. The Gisholt Machine Co., Madison, Wis. This product is described in a recently issued folder. A capacity chart is also included in the four pages.

Pamphlets Received

The Test of Metals for Hardness. By Stanley P. Rockwell, Consulting Engineer, 65 Highland St., Hartford, Conn. This is an authorized reprint from the August, 1922, transactions of the American Society for Steel Treating whose headquarters are at 4,600 Prospect Ave., Cleveland, Ohio. Charts, tables and equations aid the author in telling the story.

The Fallacy of Price-Fixing. By George E. Roberts, vice-president the National City Bank of New York. This is a reprint of the speech made by Mr. Roberts on Feb. 6 at the College of Agriculture, Ohio State University, Columbus, Ohio.

Forthcoming Meetings

National Metal Trades Association. Twenty-sixth annual convention. Hotel Astor, New York City, April 23 and 24. L. W. Fischer, National Secretary, Peoples Gas Building, Chicago, Ill.

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1315 Spruce St. Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron market quiet. No. 2 foundry iron firm at $23@$24 per ton, Birmingham. Price of steel shapes and plates fairly well established at $2.50 per 100 lb., Pittsburgh; shading to $2.40, however, reported on especially large tonnages. Steel buying quiet with exception of bars, which remain firm at the $2.40 base. Firmness in semi-finished steel.

Advances—Higher price tendencies in all non-ferrous metals except zinc. Tin and antimony lead the market in advances. Copper, ¼c. per lb. higher than on Feb. 29; demand heavy. Aluminum, antimony, solder and rubber belting prices higher in New York. Antimony, babbitt metal, roll sulphur, linseed oil, fabricated brass and copper, and scrap metals prices up in Cleveland.

Declines—Zinc down 22½c. per 100 lb. since Feb. 29. Lead demand moderated. Drill rod discounts increased about five points. No other declines of importance.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	23@24
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	3.00	4.34	3.75	4.00
No. 12	3.10	4.39	3.80	4.05
No. 14	3.20	4.44	3.85	4.10
No. 16	3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.45	4.70
Nos. 22 and 24	3.75	4.70	4.50	4.70
Nos. 25 and 26	3.80	4.75	4.55	4.75
No. 28	3.85	4.85	4.65	4.85
Galvanized				
Nos. 10 and 11	4.00	4.90	4.70	4.85
Nos. 12 and 14	4.10	5.00	4.80	4.95
Nos. 17 and 21	4.40	5.30	5.10	5.24
Nos. 22 and 24	4.55	5.45	5.25	5.40
No. 26	4.70	5.55	5.50	5.55
No. 28	5.00	5.85	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....]
Drill rod (from list)	55@60%	40@55%	50%]

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York				14.62½
Tin, 5-ton lots, New York				58.00
Lead (up to carlots), St. Louis	9.50	New York		9.87½
Zinc (up to carlots), St. Louis	6.65	New York		7.15
	New York		Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	28.00		29.00	28.50
Antimony (Chinese), ton spot	12.50		13.25	10.25
Copper sheets, base	21.00		22.00	23.00
Copper wire, base	16.50		19.75	16.25
Copper bars, base	20.00		23.25	19.50
Copper tubing, base	23.00		28.00	23.00
Brass sheets, base	17.75		22.50	18.75
Brass tubing, base	22.00		27.50	20.50
Brass rods, base	15.50		18.50	15.75
Brass wire, base	18.25		22.50	.....
Zinc sheets (casks)	10.75		11.00	.....
Solder (½ and ¼), (case lots)	39.00		41.50	30.00
Babbitt metal (83% tin)	60.00		67.00	48@52
Babbitt metal (35% tin)	28.00		22.00	22@25
Nickel (ingot and shot)	29.00		.....	.....
Nickel (electrolytic)	32.00		.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.00	11.50	11.50
Copper, heavy, and wire	10.75	11.00	10.75
Copper, light, and bottoms	9.75	10.00	9.75
Lead, heavy	7.75	7.00	6.00
Lead, tea	6.50	4.50	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	9.25	10.00	9.00
Brass, light	6.00	6.00	6.25
No. 1 yellow brass turnings	7.00	6.50	6.75
Zinc	4.00	3.50	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	11.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb	11.50	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.50	3.50
Linseed oil, per gal., 5 bbl. lots	.97	1.08	.94
Lard cutting oil, 25% lard, per gal.	.58	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	.80@1.35	1.01	.97
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.00@4.50
Coke, prompt foundry, Connellsville	per net ton		5.25@6.50
White lead, dry or in oil	100 lb. kegs		New York, 15.00
Red lead, dry	100 lb. kegs		New York, 15.00
Red lead, in oil	100 lb. kegs		New York, 16.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0334
Cold finished shafting	per lb.	0.044	0.044	0.042
Brass rods	per lb	0.155	0.15	0.1937½
Solder (½ and ½)	per lb.	0.39	0.3675	0.335
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.58	0.58	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1½ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	75%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 9/16 and smaller	65%	.....	.....
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

New and Enlarged Shops

Machine Tools Wanted

Ala., Bimingham—G. R. Mueller Co., Brown-Marx Bldg. (dealer)—one set of plate bending rolls, width between housings about 8 or 9 ft., capacity ¼ to ½ in. plate; bending brake to bend plates 6 to 8 ft. long and from ¼ to ⅜ in. thick; angle bending rolls, capacity up to 6 x 6 in. angles; vertical punch, capacity about 1 in. through 1 in. or greater, 36 to 48 in. throat.

D. C., Wash.—Southern R.R., Southern Bldg., C. R. Craig, Genl. Purch. Agt.—36 in. vertical turret lathe and 30 in. vertical boring mill.

Ill., Chicago—Liddell Co., 2911 West Lake St. (manufacturer of copper store fronts), F. B. Liddell, Purch. Agt.—drill presses and punches for branch at Woodstock, Ill.

Mass., Fitchburg—Jennison Co. (metal workers)—12 ft. squaring shears, ¼ in. capacity; 12 ft. bending roll, ¼ in. capacity; angle iron cutter, capacity ½ x 4 x 4 in.

Mich., Detroit—C. H. Hanze, 280 Harmon Ave.—14 in. geared crank shaper, compound arbor press, No. 2 Toledo press and No. 80 Niagara foot press.

Mich., Detroit—Lee Mchy. Co., 3171 Bellevue Ave.—No. 20 Bath grinder; No. 6 Whitney hand mill; 36 x 12 and 16 x 6 lathes; Ackley and Abbey ring millers; Fay automatics; 1 to 1¼ and 2 in. bolt threaders; No. 1 La Point broach; Porter cable lathe; No. 1 B. & S. Universal grinder (new or used).

Mo., St. Louis—Perfection Mfg. Co., 2701 North Leffingwell Ave. (manufacturer of novelties)—gang punch press with bed 36 in. long, for very light work.

N. Y., Evans Mills—C. Lortscher (repair shop)—electrically operated grinder, also 18 or 20 in. vertical post drill.

N. Y., New York—Wilson Mfg. Co., 137 Grand St. (manufacturer of tools and dies), A. W. Wilson, Purch. Agt.—21 D Bliss press, also V. & O. press, 3½ or 4.

N. Y., Salem—Acme Road Mchy. Co., R. Brink, Supt.—14 in. x 8 ft. engine lathe.

N. Y., Watertown—H. W. Thornhill Co., 219 Gale St. (electrical contractor)—lathe for magneto and coil winding, also portable drill, 60 cycle, 3 phase, 110 volt.

O., Columbus—Miller Machine & Mold Wks. Co., 705 Ann St., E. Miller, proprietor—grinder and air compressor.

O., Mansfield—Ohio State Reformatory—36 in. shear for 14 gage and heavier material; 22 in. upright drilling machine, capacity 1¼ in. drills.

Wis., Janesville—A. A. Russell, 27 South Bluff St.—grinder and tool room lathe for garage.

Wis., Milwaukee—Dunning Heating Supply Co., 131 Reed St.—sheet metal machinery.

Wis., Milwaukee—Husky Wrench Co., 926 16th Ave.—flywheel punch press and ¾ in. high speed ball bearing drill press.

Wis., Milwaukee—Refrigo Corp., 1112 Forest Home Ave. (manufacturer of refrigerators), P. A. Hempe, Purch. Agt.—No. 2 milling machine, 18 in. x 6 or 8 ft. tool lathe, 20 in. shaper, small Barnes drill press with No. 3 Morse taper.

Wis., Wisconsin Rapids—Nash Hardware Co., 2nd St. and Grand Ave.—sheet metal machinery, shop equipment and small tools.

Ont., Brinston—H. B. Cook—drill press and lathe for garage.

Ont., Cardinal—G. Raycroft—drill press and small lathe for garage.

Ont., Manotick—J. Patterson—drill press and grinder for garage.

Ont., St. Thomas—Canadian Natl. Ry., 230 St. James St., Montreal, Que., G. W. Caye, Purch. Agt., and Wabash Ry., Railway Exch. Bldg., St. Louis, Mo., T. J. Frier, Purch. Agt.—equipment for proposed $220,000 locomotive shops, here.

Que., Montreal—L. A. Ott, 10 Cathcart St., Perrault & Gadbois, 2010 Park Ave., Purch. Agts.—equipment for proposed large garage at Outremont.

Machinery Wanted

Conn., Middletown—Burns Lace Mfg. Co., Cooley Ave., South Farms—six copper tubs, 18 ft. long.

D. C., Wash.—Bureau of Yards & Docks, Navy Dept.—pneumatic ash handling system for Navy Yard, New York.

D. C., Wash.—A. L. Flint, Genl. Purch. Officer Panama Canal—receiving bids until Mar. 18 for iron and steel, galvanized pipe, bronze, copper, brass tubing, hand trucks, riveting forges, steel dies, pressure gages, wood and steel blocks, etc.

Kan., Newton—City, A. Martin, City Clk.—hand power traveling crane, 5 ton capacity, 49 ft. span.

La., New Orleans—Bd. Port Comrs., Suite 200, New Court House Bldg., J. H. Walsh, Genl. Mgr.—receiving bids until Mar. 20 for furnishing under two separate contracts, equipment for coal handling plant extension. Requisition E. D. 14,643, two electric capstans; Requisition E. D. 14,644, machinery for 500 lin.ft. of belt conveyors.

Mich., Detroit—G. R. Spaulding, 1507 Parkview Ave.—machinery for woodworking shop.

N. J., Trenton—State, State Bldg.—weighing machine, traveler, etc., for proposed $250,000 power plant.

N. Y., Dekalb Junction—Dekalb Dairy Co., Inc., I. Streeter, Purch. Agt.—machinery and equipment for 20 ton ice making plant.

N. Y., New Paltz—United Battery Corp., J. C. Wetmore, Purch. Agt.—special machinery and equipment for the manufacture of ignition, radio and electrolytic storage cells.

O., Alliance—F. A. Hoiles, representing owner—brick making machinery for proposed large plant near Darlington, Pa.

O., Dayton—Green & Green Co., Concord St.—special ovens for proposed $450,000 baking plant.

Okla., Ponca City—Ponca City News—machinery for proposed printing plant.

Vt., Bennington—G. E. Rockwood & Co., 915 Main St. (knit goods)—cotton picker, garnet, duster, fan, etc., complete unit for getting out garnetted stock.

Wash., Tacoma—City Commissioner of Light & Water—receiving bids until Apr. 15, for machinery for Power House 1, including 2 hydraulic turbines, vertical type, 27,500 hp. each, with auxiliaries; 2 electric generators, vertical type, rated at 20,000 kva., with auxiliaries; 24 transformers, various sizes, 37½ to 14,100 kva., with auxiliaries; one electric synchronous condenser, 15,000 kva.

Wis., Manitowoc—Meyer Mfg. Co., 1701 Washington St., J. Meyer, Purch. Agt.—wood and metal working machinery for the manufacture of coaster wagons, etc.

Wis., Menominee—New Hudson Road Creamery Co., C. Oberle, Secy.—refrigeration machinery and equipment for creamery.

Wis., Milwaukee—Bldg. Finance & Constr. Co., 756 12th St.—machinery, belting, shafting, etc., for proposed $60,000 laundry.

Wis., Milwaukee—Builders Millwork Co., 1014 30th St. (manufacturer of interior woodwork), J. Ranwald, Purch. Agt.—12 or 16 in. jointer, double arbor trim saw and one cutoff saw.

Wis., Milwaukee—Pittsburgh Plate Glass Co., 205 Lake St.—paint making machinery and equipment.

Wis., Milwaukee—United Woodwork Co., c/o C. Fels, 606 26th St. (manufacturer of furniture frames)—sander and glueing machine.

Wis., Oshkosh—Gould Mfg. Co., 10th St.—woodworking equipment, also equipment for battery of dry kilns for proposed $100,000 factory.

N. S., Mill Village—F. L. Mack—one 60 hp. rotary mill complete.

Ont., Crysler—J. Page—surface planer and moulder for sash and door factory.

Ont., Heckston—C. Sloan (sawmill)—rip saw and table.

Ont., North Augusta—C. Galbraith (blacksmith)—bench grinder and drill.

Ont., Osgoode Sta.—J. E. Saunders (blacksmith)—bench drill, also forge with hood and blower.

Ont., Perth—James Bros., Herriott St.—moulding machines, dippers and other equipment for proposed addition to foundry.

Ont., Riverside—F. J. Kirsch—pumps and equipment for proposed $150,000 brewery.

Ont., Sudbury—Spanish Mills Co., Ltd.—saws, resaws, conveyors, etc., for proposed sawmill.

Ont., Sudbury—Sudbury Laundry Co., J. R. Binet, Purch. Agt.—machinery for proposed addition to plant.

Ont., Toronto—Hydro Electric Power Comn. of Ontario, 190 University Ave.—two transformers, one for Essex substation and one for Sarnia.

Que., Hull—A. H. Coplan Co., 207 Montcalm St. (manufacturer of locomotive grates)—core making machinery, ladles, cupola and conveyor system for foundry at Ogdensburg, N. Y.

Que., Lachine—Lachine Welding & Nickle Plating Co., 129 1st Ave., P. Carmoni, Purch. Agt.—welding machine and other shop equipment.

Que., Montreal—Algonquin Veneer & Lumber Co., Ltd., c/o J. Martineau, 232 St. James St.—complete equipment for planing mill.

Que., Ste. Flore—J. Rheault (sash and door factory)—glue jointer and jig saw machine.

Metal Working Shops

Calif., Kerman—The Trustees of Kerman Union High School Dist. are receiving bids for the construction of manual training shops and garage. A. Johnson, Kingsburg, Archt.

Calif., San Francisco—The California Garage Syndicate, c/o J. L. Stewart, Archt., Claus Spreckels Bldg., is having plans prepared for the construction of a 10 story, 155 x 300 ft. garage on 4th St. near Jessie St. Estimated cost $2,500,000. Noted Mar. 6 under L. R. Lurie, owner.

Conn., Georgetown—The Gilbert & Bennett Co. is having plans prepared for the construction of a 3 story, 48 x 110 ft. and 2 story, 25 x 63 ft. wire mill, also 1 story, 30 x 33 ft. substation. Estimated cost $80,000. Greenwood & Noerr, 847 Main St., Hartford, Engrs. and Archts.

Ill., Mount Vernon—The Mount Vernon Car Mfg. Co. awarded the contract for the construction of a 1 story, 200 x 260 ft. addition to its plant. Estimated cost $150,000.

Kan., Wichita—The Coleman Lamp Co., North St. and Francis Ave., awarded the contract for the construction of a 2 story, 60 x 90 ft. addition to its factory. Estimated cost $65,000.

N. Y., New York—Bloomingdale Bros., Lexington Ave. and 59th St., will soon receive bids for alterations and construction of addition to garage at 410 East 54th St. Estimated cost $400,000. E. H. Janes, 70 East 45th St., Engr.

O., Cleveland Heights (Warrensville P. O.)—The L. Stone Estate, 501 Rockefeller Bldg., Cleveland, will soon award the contract for the construction of a 2 story, 80 x 140 ft. garage, etc., on Mayfield and Superior Rds., here. Estimated cost $150,000. C. A. Matheny, 1969 East 70th St., Cleveland Archt.

Okla., Tulsa—C. Z. Wiley, 1201 South Boston St., plans to build a 3 story, 100 x 140 ft. garage and sales room on 12th and Boston Sts.

Pa., Phila.—The Phila. Electric Co., 10th and Chestnut Sts., awarded the contract for the construction of a 2 story, 60 x 101 ft. maintenance shop on 26th and Christian Sts. Estimated cost $100,000. Noted Feb. 21.